DETERMINANTS OF HOUSE PRICES IN LEBANON: AN ARDL APPROACH

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Abstract

Purpose: The purpose of this thesis is to investigate the variables affecting house prices in Lebanon in the long run and the short run.

Design/ Methodology/ Approach: To answer the above question, data collected is a monthly one covering second half of the year 2013 until February 2021. The dependent variable is average housing price, while independent variables include employment idex, construction permits, non-resident deposits, interest rate, CPI, and coincident indicators. The autoregressive distributed lag (ARDL) model is applied for the long run and the error correction model (ECM) is applied for the short run.

Findings: The results show that, in the long-run, the employment index (EI), which is a proxy of employment, affected house prices. In the short run, EI, construction permits, and interest on USD loans (USD) affected house prices in Lebanon.

Research Limitations and Implications: There are various limitations concerning the thesis. First, average house prices do not necessarily represent housing since real estate is both residential and commercial. Second, average house prices differ from median house prices which are a more fair representation of housing whose data is not available. Third, there are no large datasets in Lebanon and data used in the thesis was limited to being less than 100 observations.

There are also several implications. Findings will help policymakers determine which variables affect housing and how they could structure their policies based on the information. Real estate develepors will know when to build housing units and how to build and price them. It can also help the average house buyer determine the right time to buy a house.

Originality and Value: This thesis is actually one of the first researches and studies ever conducted on housing in Lebanon and thus would add value in both its novelty and content while hopefully paving the way for other researches later down the line being conducted on housing in Lebanon. Its value is also deriveed from the quality of information included.

Keywords:

Housing, Average House Prices, ARDL, ECM, Long Run and Short Run.

Chapter 1: Introduction

1.1. Background

Housing and real estate have been phenomena across multiple economies and civilizations across different periods. The sector represents both a want and a need. Some use real estate to keep a roof over their heads, others use it as a show of wealth and splendor and there are even some who use it for tax incentives and get returns in the form of rent. All buyers consider it an investment since, almost always, prices are on the rise. It has been the root cause of many economic recessions (most notably in 2008). There are several ways in which one can invest in real estate without actually paying so much for property such as through investing in Real Estate Investment Trusts (REIT) which are companies that buy real estate assets (commercial or residential) or mortgages and have shares sold to investors. Mortgage REITs are those which invest in Mortgage-Backed Securities and can yield dividends of up to 28% such as Two Harbors Investment Corp. They allow the investor to play the role of a lender which makes them rather risky. Asset REITs, on the other hand, allow the investor to benefit from almost all of the perks of owning real estate (earning rental income and having an appreciable asset or asset portfolio) without having to deal with the problems associated with owning rental properties such as angry tenants calling about malfunctions in the property since the REIT hires its team of managers in some cases depending on how well it is managed. Others even construct their properties and hereby provide work for the construction sector and related sectors on a macroeconomic scale. This is also true for Lebanon where construction alone employs 8.9% of the population (CAS Database) and its effects trickle down to the rest of the labor force who also benefits in a direct way such as realtors, plumbers, cement

experts, or in an indirect manner such as the latter's suppliers making the real estate sector the contributor of almost 15% of Lebanon's GDP in 2016 (Fransabank,2017).

In Lebanon, real estate is a particularly interesting sector, since it has witnessed major ups and downs in the three decades from 1990 to 2020. In fact, in that interval, Lebanon saw the end of a civil war (1990) where Beirut and its outskirt had several damaged or destroyed properties which jumpstarted the construction boom and saw the rise in upscale properties in Beirut (particularly the downtown area) and the investment by Gulf Country nationals in Lebanese high-end real estate and even causing other villages to flourish as a result such as Bhamdoun, Aley, and Hammana to mention a few. Next came the 2006 summer war with Israel which saw several homes in Lebanon's south being bombarded and the decline of the general real estate market. Afterward came the 2007 war in Nahr el-Bared which drove down prices even further. It became worse in 2011 when the Syrian civil war broke out and foreign investment vanished leaving only the investments made by expatriates (Tierny,2017). In 2018, the Lebanese Central Bank cut the Iskan program (providing housing loans at 3% for up to 30 years and up to LBP800,000,000) which many experts believe led to the first Lebanese recession in at least a decade. In 2019, the Lebanese Lira started depreciating due to a liquidity squeeze which only worsened in 2020 after the ongoing struggle with COVID-19 and the Beirut Port explosion on August 4, 2020, so far.

However, there also were boom years. For starters, the reconstruction of Beirut had taken off after 1990 as both Achrafieh and the downtown areas were habitable and luxurious. In fact, in 2010, the number of real estate transactions reached 94,320 and, in the timespan, ranging between 2011 and 2018, the value of real estate transactions climbed to record highs reaching USD9.95 billion in 2017 (BRITE Database). This shows that people were willing to buy and sell and the

market was growing. In Lebanon, real estate has always been a key asset in a typical Lebanese investment portfolio since post-civil war times. This is because, after the civil war, there were limited investment opportunities especially when considering the fact that the Beirut Stock Exchange was still halted and any other capital already fled the country. In that period, property prices were at an all-time low since most of it, especially in Beirut, was badly damaged if not destroyed. The Saint Georges Hotel in downtown Beirut is one of the many examples of real estate losses. Once the most prominent hotel, restaurant, and boating club combined is now reduced to nothing more than a damaged, deserted building whose owners couldn't start renovating until late 2019 since then prime minister Rafic Al Hariri and later his son Saad refused to provide the owners the permit to force them to sell the hotel for pennies on the dollar as with most parts of downtown to Solidere, the sole real estate company that had the permission to rebuild Downtown Beirut hereby turning it into a monopoly and whose main shareholders were the Hariri family. Outside the downtown area, however, anyone looking to invest in Lebanon could purchase a property, renovate or rebuild it and sell it for profits. Meanwhile, the buyers can benefit from buying a renovated property that has two main benefits: first, it secures a roof over their heads and their family's or a place to do business, and second, it is an appreciating asset that increases in value almost every year. This means that even if they were to take on a fixed interest loan, they can still benefit from paying a constant payment that increases their equity in the house that is appreciated in the market. This increase in prices is good for established buyers who bought their homes cheap, but it is horrible for the young buyers who want to start a family of their own since the prices are going up and it becomes more difficult every year to buy a house without a mortgage. If we were to look at the numbers, the price-to-income ratio of Lebanon is 14.07, based on the Numbeo database which is one of the largest cost-of-living databases in the world. The ratio is obtained by

dividing the median cost of a 90 SQM apartment in a country or city by the annual median disposable income in that country or city. Based on the Numbeo database, we deduce that this number is very high when compared to other cities like Austin, Texas which has a ratio of 3.62 or Los Angeles, California which has a ratio of 7.17 or even New York with a ratio of 10.22 bearing in mind that the last two are considered very expensive areas in the United States and two of the most expensive in the world. Lebanon, however, remains cheaper than Paris, which has a ratio of 21.65 (Numbeo database) and which is in very high demand from buyers across the globe. It is, however, unreasonable to compare Lebanon to other nations (specially developed ones) and this begs a lot of questions that need to be addressed and answered to gain perspective on the Lebanese housing system.

This thesis will address the following two questions:

Research Question 1: What are the parameters affecting home prices in Lebanon?

Research Question 2: What are the short-run and long-run impacts of these parameters?

To answer the above questions, we will use secondary data. More specifically, data related to Lebanon will be retrieved from BRITE (BLOM Research Indicators and Trends in the Economy). The period of the study extends from the second half of the year 2013 until February 2021. inclusively and in monthly data. The variables that we will use are construction permits, consumer price index (also referred to as CPI), employment index, coincident indicator, non-resident deposits, interest on USD loans, and interest on LBP loans.

1.2. Need for The Study

Housing has always been a significant factor in determining the future of both individuals and societies since it acts as both an essential ingredient of prosperity and stability and also the subject of economic recessions. This can be attributed to the common knowledge that a house is the best investment while the government keeps lending larger and larger sums of money at low-interest rates even though prices are constantly on the rise and often overpriced. The same can be said about Lebanon where the price/income ratio is 14.07 and without considering the current 80% depreciation of the Lebanese Lira that has been dragging on due to the recession that has started in 2018 and which worsened due to COVID-19. In addition, prices are still high even though youth unemployment keeps exceeded 17% since 2011 (BRITE Database).

Considering the current situation of the Lebanese economy as briefly discussed above, and considering the fact that there is no previous in-depth literature written on the matter, this thesis will be the first scientific reference devoted to studying the pricing process of houses and together with the current housing parameters affecting the whole sector in Lebanon. This thesis will serve as a guide for decision-makers to draw the financial policy to enhance the housing sector and establish social equity and fairness. In addition, it will help construction entrepreneurs consider the different aspects when they build, aspects that include where and how to build and what could be a fair selling price for homes.

1.3. Aims of The Study

Every year, more and more Lebanese youths delay their marriage due to the increased housing costs associated. It has become so bad that even those who did save money in the bank for a down

payment or even a house, lost it since banks stopped US Dollar withdrawals which caused panic and depreciated the value of the Lebanese Lira by 80%.

Overpriced real estate benefits the billionaires of Lebanon through government subsidies while hurting the economy by making the government the sole lender for housing at low rates. It also affects the taxpayer since such a program is uselessly expensive because, after 2020, the policies within the program proved to be inefficient. Finally, it hurts the citizens by forcing them to buy houses at expensive prices and binding them to overpriced housing payments for 10, 20, and even 30 years which hinders the process of creating true wealth on both the personal and societal level.

The thesis aims at answering the two main questions mentioned above:

- What are the parameters affecting home prices in Lebanon?
- What are the short-run and long-run impacts of these parameters?

To answer the above questions, we will gather data on factors that might be related to house prices in Lebanon based on studies done previously. These variables include employment Index, interest on USD loans, interest on LBP loans, construction permits, coincident indicators, non-resident deposits, and inflation and run them in an ARDL model to conclude which variables have a short-run and long-run impact on house prices in Lebanon.

1.4. Outline of The Thesis

This thesis is structured as follows: First, Chapter 2 presents a review of literature of several studies which wanted to determine the impact of certain criteria on house prices in several nations. Second, Chapter 3 presents the variables that will be used in the thesis while also outlining the methodology

that will be used. Next, Chapter 4 discusses and interprets the findings while linking them to the existing findings in the previous studies discussed in Chapter 2. Finally, Chapter 5 concludes the thesis with discussions and implications.

Chapter 2: Literature Review

The purpose of this chapter is to discuss the previous studies conducted on the subject of housing prices in different countries and observe the different variables they considered in their studies. It will start by introducing the overall aspects and facts of the housing sector of Lebanon. Next, it will discuss some government policies implemented in different nations and observe the different variables that were studied and to what degree they impact house prices in different nations followed by a summary of the most common variables.

2.1. The Reality of Housing in Lebanon

Housing in Lebanon is certainly a unique example of the Lebanese culture and people. Across its 10,452 km^2 one can almost always find uniqueness in buildings that separate one city from another with a mixture of both traditional and modern techniques and designs. Cities and areas pride themselves to be separate from others through their unique conditions for granting construction permits at the municipal level. In the mountain regions of Lebanon like the upper parts of Kesserwan, municipalities always try to encourage builders to have a brick roof as a sign of maintaining traditional characteristics of buildings which results in many modern-looking buildings that have a traditional brick roof. For example, in Deir al Qamar, the municipality won't grant any construction permits to builders who don't plan on building the whole structure from stone, adding a brick roof, and arching their windows and balconies. In the city of Jbeil, the municipality and the citizens have gone to great lengths to maintain the city's ancient décor and

splendor as buildings are built around ancient monuments and landmarks even in the city square where some of the roads are also made of cobblestone as opposed to Beirut where Solidere has gone to great lengths to bury the ancient landmarks under the most over-glorified area in Lebanon.

Yet despite all these restrictions, construction permits granted have increased from 5,514 in Mount Lebanon out of 11,614 granted in all of Lebanon in 2000 to 5,823 out of 13,388 in 2017 (OEA Database). Also, the value of real estate transactions in Lebanon has increased from USD 3.14 billion in 2006 to USD 6.84 billion in 2019. However, the number of real estate transactions increased from 50,140 in 2006 to 50,352 in 2019. This means that the value of real estate transactions increased by 117% while real estate transactions increased only by 0.42% in that same time period (BRITE Database). This gap might have resulted from several mismanagements by the different governmental bodies of Lebanon. However, the one that stands out most is the Lebanese central bank (BDL) and the monetary policies it implemented. BDL implemented two differing and counteractive monetary policies. On one hand, BDL increased lending to housing through Banque de L'Habitat and the Public Corporation for Housing by issuing debt worth USD 892.27 million all in Lebanese Lira at rates ranging from 5% (in 2011) to 3% (in 2017) on new loans (BRITE Database). On the other hand, BDL channeled all the cash in the economy to the banks by increasing the interest rates on deposits in LBP and USD where in 2018, banks in Lebanon started granting 15% interest on USD deposits exceeding USD100,000 provided the client agreed to convert them to LBP at the pegged rate and agree to have the principal frozen over 60 months. BDL effectively had two different interest rates which caused the value of real estate transactions to increase while real demand for real estate remained relatively stagnant. The value of real estate transactions and ultimately home prices was purely affected by the central bank's conflicting monetary policies in Lebanon whereas other factors had a major effect on house prices

in other countries. This is known due to an abundance of studies conducted on the different factors that might affect house prices in other countries such as personal income levels which appeared to be a real factor in countries like China, the USA, and the UK. Interest rates also seemed to be a recurring theme in China, North Korea, the UK, Australia, and New Zealand among other factors as well. Yet when we look at Lebanon, there seems to be no scientific study conducted to determine the real factors that affect the value of house prices and whether or not these prices are inflated or fair.

2.2. Government Policy Overview

It has often been a major issue among scholars and politicians that government needs to be involved in housing and devise several policies and laws to help poor families afford a home. Government assistance for housing comes in forms ranging from government-sponsored enterprises (mainly Fanny Mae and Freddie Mac) buying up already issued housing loans from mortgage lenders to encourage them to lend more by constantly supplying them with liquidity. Marshall and Concha (2012) supported Fannie Mae and Freddie Mac arguing that these enterprises should offer an amnesty for the borrower and freeze their mortgage until the property mortgaged is sold. Acharya et al. (2011) opposed Freddie Mac and Fanny Mae and proposed that their guarantee business should be fully privatized. Another way in which the government can be involved with housing is through public housing. It first started with the public Housing Act of 1937. This act allows the government to build and operate sanitary rental properties at low rental rates for families in the lowest income group. This was opposed by many scholars such as Thomas Sowell (2011) who stated that it is a fallacy that affordable housing requires government intervention and went on to argue that in 1901, housing cost Americans an average of 23% of their

incomes (before government intervention) and by 2003 that number increased to 33% (after government intervention) and in San Francisco where there is more intervention, the numbers were steeper. In 1970, families could pay off their mortgage in 13 years using only 25% of their income. In 1980, mortgages needed 40% income and 30 years and in 2011, they need 50%. Public housing units also became a source of crime and indigence for the societies where they were located (Friedman, 1977).

2.3. Literature on Chinese Housing

Li and Chand (2013) tried to answer two questions: "How much of the real appreciation in housing prices can be explained by market fundamentals?" and "What are the most important factors in determining housing prices in each province?". To do so, they first collected data on chosen variables which were the age of marriage, household income, land cost, construction cost, and interest rates on housing loans in China in the period ranging from 1998 to 2009 inclusively. Then, the researchers made up a model composed of two equations whereby the first sought the dependent variable to be housing prices with independent variables being income, age, utility costs (since there were no records of previous rent prices), and previous house prices (price per square meter). The second equation had the cost of housing as a dependent variable with the independent variables being house prices, construction cost, land cost, interest on housing, and supply of housing in China. The study then equated the two models. The results showed that, in China, house prices were mostly and positively affected by age of marriage, disposable household income, and construction cost. Interest rates had a statistically negative sign but quantitatively small impact on house prices. In addition, the land cost had a significant positive impact on house prices.

Li et al. (2018) studied the effect of disposable household income on housing prices along with the other macroeconomic factors in China which were GDP and money supply (M2) and interest rates. The study was done in the cities of Beijing, Shanghai, and Tianjin and tried to recommend policies that the government can implement to control house prices. The paper tested data using Vector Auto Regression and the Johansen co-integration test. The results show that house prices were closely and positively correlated to GDP, disposable income, money supply, and interest rates. They also show a positive correlation of money supply to disposable income and GDP since incomes rise the more liquidity is injected into the economy. The Chinese government has control over interest rates and money supply which affect GDP and disposable household income indirectly. The journal concludes that if the government wishes to lower prices, it should restrict the money supply and /or increase interest rates to curb demand.

Interest rates were also considered by Arestis and Jia (2019) who examined the effects of different financing channels (shadow banks and normal lenders) on the Chinese house prices in the short and long run. The variables used were the mortgage rate, housing loan interest rate, residential investment, and the level of housing completion. To do this they used three equations. The first measures the demand for housing with the variables being disposable household income per capita, mortgage rate, housing loan rate, stock price, and the scale of shadow banking. The second one measures the supply of housing using the level of residential investment, the scale of shadow banking, lending to real estate development, and the level of housing completion as the variables. The third one is the house pricing model which measures the long-run equilibrium price where demand and supply are equal. The variables used in the third equation are the variables used in the first and second equations. Results show that stock price and disposable household income per capita have a positive effect on house prices whereas residential investment, housing loan rates,

mortgage rates, and housing completion harm house prices. In the long run, the housing loan rate has a greater effect on prices than mortgage rates, while the opposite is true in the short run. The study concludes that Chinese authorities have different ways to regulate the housing market and that shadow banks cause volatility since they affect both the demand and supply of housing.

Wang and Rickman (2020) studied the effects of the supply on the demand in Chinese real estate to identify the effect of housing supply on housing prices in mainland China (excluding Hong Kong, Macau, and Taiwan) in addition to the effect of regional housing supply growth on population growth for the period ranging from 2002 to 2015. This was done by using the spatial equilibrium growth model developed by Glaeser and Tobio in 2008. They separated the effect that demand had on housing supply as it was not an intended objective of the study. They then examine broad geographical differences in housing supply for provinces, autonomous regions, municipalities under central government control, and non-municipal major cities. The study found that relative differences in land supply played a major role in differences in housing price growth across mainland China whereby as land supply increases, growth for housing prices doesn't increase or increases by a slight amount. This is evident as Shanghai has seen the fastest housing price growth and the smallest land supply (for house construction). It also shows that as land supply increases, population growth rates increase.

Finally, Haizen, Yan, and Ling (2014) sought to examine the effects of educational facilities on housing prices in Hangzhou, China. The study adopts a traditional hedonic price model and spatial econometric models to evaluate the impact of various educational facilities (kindergarten, primary, junior, and senior high school, and university) on housing prices using data from 660 communities. The results showed that different educational facilities have varying positive effects on house

prices and residents are willing to pay more for access to high-quality education facilities. It also concluded that houses within a 1-kilometer radius from a kindergarten are, on average, 0.3% more expensive. Additionally, when the education quality of a junior high school increases by one level, prices increase, on average, by 5.443%, and when the quality of a primary school increases by one level, house prices increase by 2.020%. Also, the presence of a high school and college increases house prices by 2.737% and 0.904% respectively.

2.4. Literature on South Korean Housing

Kim and Min (2011) conducted a study to measure the effect of interest rates, housing supply, and overall lending by banks to households on the Korean Bubble during the period between 1986 and 2003. The study used regime-switching regression models which involve using several structures or equations that characterize time series behaviors over different regimes. The study concluded that the creation of bubbles in the housing market is affected by all of the above factors, however, some factors had an effect more severe than others. The interest rate effect on Korean housing markets was rather insignificant when compared to that of overall lending to households and aggregate monetary policies as the regression saw insignificance of interest rates and contrary significance when it came to housing supply and abundance of credit granted to households.

2.5. Literature on US Housing

McCarthy & Peach (2004) tried to study the relation between market fundamentals and house prices using a structural model. The study used measures beyond price-to-income since declining mortgage rates compensate for the increase in prices and in measuring mortgage payment to household income, the ratio was stable at 15%. It also denounced rent-to-price since it measures a stable property collecting rent and it fails to account for declining interest rates. The authors

calculated house prices using interest rates and median household income. They concluded that there is no major housing bubble and home prices have risen due to income increases. As for house price increases, in some states, they have been the result of housing supply inelasticity and the disjointed nature of the US housing market.

Another study conducted by Rubio (2011) emphasized the effect of variable and fixed interest rate changes on housing and household consumption in the overall United States economy. The interest rate is set endogenously by the government as a result of inflation and output. There are two types of consumers of housing: constrained (borrow at a variable or fixed rates) and unconstrained (they don't need to borrow to pay for a house). The author concludes that consumption decreases when interest rates increase if constrained individuals have a variable rate and increased interest rates decrease the overall prices of houses (Rubio,2011).

Also, Bahmani-Oskooee and Ghodsi (2016) studied short-term and long-term relations between house prices and economic fundamentals (interest rates and median household income). They did so by using non-linear ARDL for cointegration and error correction on quarterly data from all US states. The results show that fundamentals have asymmetric effects on house prices in the short run and long run. The study concludes that expansionary monetary policy to lower interest rates will stimulate demand over time. However, due to the asymmetric effects of interest rates, the Fed should be cautious since the contractionary monetary policy will not help fight bubbles since raised interest rates didn't affect demand and house prices.

Bork and Moller (2018) examined house price forecastability using principal component analysis (PCA), partial least squares (PLS), and sparse PLS models. They chose interest rates as one of the independent variables along with income, employment, credit conditions, and housing

construction conditions among several others including housing sales conditions, consumer confidence, NAPM surveys, and credit spreads in the run leading up to the 2008-2009 crisis which adds up to more than 100 variables. The whole idea of their study is to find a better house price prediction model than the price-rent ratio models. In the SPLS model, they used cross-validation to determine the optimal number of factors and optimal degree of sparsity. The most important macroeconomic variables for prediction include short-term interest rates, credit spreads, NAPM survey measures, employment, the personal savings rate, housing market sales conditions, and consumer confidence. They concluded that the SPLS model has strong predictive power for future house prices as it strongly outperforms price-to-rent ratio, autoregressive and regressive models. They also conclude that short-term interest rates, credit spreads, NAPM survey measures, (un)employment, the personal savings rate, housing market sales conditions, and consumer confidence are important predictors to house prices.

Benamraoui (2018) analyzed the relationship between the key economic fundamentals and house prices before and during the 2007-2009 financial crisis in the USA and UK. He identified the factors to be interest rates (short-term and long-term), changes in individuals' income, and unemployment and uses the multiple regression model to identify the degree of correlation of the factors to house prices. The results show that both in the US and UK, individuals' income was the highest correlated among the factors. Interest rates had a higher correlation to house prices in the UK than in the US since the majority of loans in the UK have short-term interest whereas 90% of US mortgages are fixed for the long term. This also shows how short-term rates have a greater impact on the demand for housing. Finally, unemployment had the least impact on predicting house prices in both economies although there was a negative correlation between unemployment and house prices.

2.6. Literature on Australian Housing

Lim and Tsiaplias (2018) conducted a study involving the effect of interest rates on city-specific house prices in Australia and their relation to household income ratios. The researchers take into consideration that there is a large regional disparity in house prices in Australia as housing is heavily concentrated on the coasts (particularly in the east). The paper targets the indirect ramifications of interest rates on housing markets. The study utilized a non-linear approach. Their study concluded that there is an interest rate threshold below which interest rates make house price increases rather unstable. In addition, these thresholds show that houses in Australia are prone to booms which the governing agencies must intervene to balance. The paper concludes the following: "The results are therefore also important in terms of the housing market implications of macroprudential policies, particularly given recent evidence that house price booms and busts are predictive of financial crises".

2.7. Literature on New Zealand Housing

Shi, Jou, and Tripe (2014) studied the effects of changes in mortgage rates and bank policies on real house prices between 1999 and 2009 in New Zealand. The rates varied between 1% and 3% on homes during that time period. In addition, borrowers had many options: they could either borrow at floating rates which change at relatively short notice (often within one month and up to six months) or they could have opted for fixed rates for a period ranging between six months and five years. Floating payers could switch to being fixed payers at any time. The research used a present value model to estimate real house price fluctuations as a result of changes in rental rates and mortgage rates. They concluded that real fixed interest rates do not have the expected negative effect on real housing prices, after controlling for household mortgage choices and other economic

conditions such as the effect of real rental rates, unemployment rates, consumer confidence, and housing credit. They also conclude that both quantity of lending and a mix of fixed and variable interest affect housing prices.

2.8. Literature on United Kingdom Housing

Begiazi and Katsiampa (2019) studied the effects of the housing market on the regional level while taking into account structural breaks (like financial crisis, UK referendum, policies, etc..) and property types (flats, terraced houses, semi-detached, and detached houses). To study different property types and regions, they employed the multi-variate GARCH model since in the univariate model the fitted conditional variance of each series is entirely independent of all others. Next, to examine the co-movements among different housing market returns, they employed the multivariate diagonal GARCH-BEKK model since it allows the examination of the movement of variances and covariances over time. The results showed that only six of the thirteen regions exhibited no structural beaks, six exhibited one structural break and East Anglia exhibited two. One of the studied structural breaks was the late 1980s boom followed by the 1990s crash. Another break was related to the Irish property bubble which affected Northern Ireland and Scotland. They also tested for ARCH effects and found that the regions with no structural breaks exhibited volatility clustering. Following this, they tested for breakpoints in the variance of each region and the results showed that they all exhibit breaks in the variance and five regions exhibit breaks in the mean equation with the other region being Northern Ireland. This can be attributed to the several policy reforms made in 1986 where building societies could offer loans and diversify which led to an increase in home ownership. They also conducted the same steps and procedures to study property types. They found evidence of the existence of structural breaks in the mean equation in

seven out of thirteen regions of the UK as well as in three out of four property types. They have also found evidence of breakpoints in the variance of six regions and three property types. The importance of the study is that first, it includes structural break test supports which strengthens the model. Second, breakpoints could be correlated with specific historical events and third, the multivariate analysis of conditional volatilities has helped examine the movements of the covariances among different regions.

Alexiou and Vogiazas (2019) investigated the critical factors that affect the UK's house prices in both the long run and the short run using the NARDL approach to cointegration vis-à-vis the standard ARDL approach to cointegration for a period ranging from 1969 to 2016. The main dependent variable is the real house price index with the two independent key variables being the price-to-rent ratio and credit-to-GDP ratio which will be subject to nonlinear testing. Industrial production, mortgage rates, and the stock market index are control variables that serve as proxies for the business cycle, housing affordability, monetary conditions, and financial activity. In addition, the equity market index serves as a leading indicator of the economy. The real house prices index is a reliable measure of residential house prices as it instantly tells if prices are rising or falling and it also serves to monitor macroeconomic imbalances and risk exposure of the financial sector. In their findings, they note that there was a positive relationship between the price-to-rent ratio and the housing price index which means that landlords still purchase houses despite increasing prices and decreasing affordability and long payback period which drives up prices even further leading to a formation of a housing bubble. The relation between house prices, mortgage rates, and industrial production is even more interesting. These factors play directly into the supply and demand law and distort the reality since house prices are increasing uncontrollably with regards to the other factors and one that UK policy makers should address immediately.

2.9. Literature Across Multiple Countries

Gupta, Andre, and Luis (2014) analyzed the co-movement in housing prices across the euro area through techniques based on fractional integration and cointegration (Gupta et al., 2014). Co-movement is tested across the economies of France, Finland, Belgium, Germany, Italy, Netherlands, Spain, and Ireland and also in relation to the Euro area aggregate over a quarterly period ranging from Q1 1971 to Q4 2012. They found that on individual country levels concerning the Euro area, France, Belgium and Germany have the most cointegration (they share borders as well) and obtained ambiguous results in the cases of Spain and Ireland. On the individual country level, however, Spain seems to have cointegration with Belgium, France, and Germany and doesn't cointegrate with Ireland and the Netherlands. Belgium cointegrates with Spain and the Netherlands, the Netherlands cointegrates with Germany, and Germany cointegrates with Spain and Ireland. In addition, co-movements in housing prices were also consistent with the findings of Vansteenkiste and Hiebert (2011) in which geographic proximity played an important role since there was a link between the house prices in Belgium and the Netherlands and between the prices in France and Spain.

Algieri (2013) conducted a study on the five main euro countries (France, Germany, Italy, Spain, and the Netherlands) along with the UK and USA to examine the key drivers affecting real house prices in those countries. The key drivers were real income per capita, real long-term interest rate, inflation rate, the main stock market index, population change, and residential investment whose data was taken quarterly from 1970 to 2010. The model adopted was the structural time series model of Harvey that was developed in 1989 since a regular auto-regressive model isn't adequate over long periods. The study concluded that prices were positively influenced by per capita income, population changes, stock indexes, and inflation while being negatively influenced by

interest rates and residential investment. It is worth mentioning that a 1% increase in population contributes to a 5.5% increase in prices in the USA, 3.2% in the UK, 2.2% in Spain, and 1.5% in the Netherlands. In addition, a 1% increase in inflation leads to an increase of 1.6% in the Netherlands, 1.97% in the UK, 1.1% in the USA, 0.64% in France, 0.3% in Spain, and 0.13% in Germany and Italy in house prices. Stock indexes have a greater effect on prices in the Netherlands, USA, and UK. Finally, the study also concluded that the common drivers in all countries were income per capita and population changes.

Sutton et al. (2017) studied the effect of short-term and long-term interest rates along with the short-term US interest rate on house prices in 47 advanced and emerging market economies including the United States of America, Austria, China, Netherlands, Bulgaria, and Estonia. They collected data from statistical authorities in the US spanning the period between 1970 and 2015 in quarterly observations and more than 1000 annual samples for the 46 remaining Economies. They argue that short-term rates matter just as much as long-term rates since both are linked to monetary policy which in turn affects the house prices in both developed and emerging market economies. The regression model that was first implemented in the US shows that in the period ranging between 1970 and 1999 shows that a 100-basis point decrease in short-term and long-term interest rates (in unison) increased real house prices by 5% after three years. When the model was implemented on non-US developed economies, a 100-basis point decrease in the US and domestic short-term rates almost yielded a 5-percentage point increase in real house prices of those economies over five years. If the short-term rate of the non-US developed economies was the only factor, that same decrease over five years almost yielded a 3-percentage point increase in house prices. When implemented in emerging economies, the same decrease in the US and domestic short-term interest rate yielded growth of 5.75 percentage points over five years. When the model

is implemented with only the domestic rate, the same five-year period yielded growth of only 2.5 percentage points. The study concluded that a gradual cut in long-term interest rates alone doesn't accelerate the creation of housing bubbles and the increase of short-term interest rates alone doesn't significantly decrease demand for housing. The paper concluded that house prices on average increase by 7% per year which makes them a good investment when considering only the appreciation in price.

2.10. Literature on Lebanon

Fawaz (2009) studied the effect of integrating an informal settlement's land and housing market into the larger affordable market of a city on the conditions of low-income earners' access to housing by interviewing one hundred property owners in Hay el-Sellom among which were late-purchasers and early purchasers. In addition, the researcher interviewed property developers and civil servants. The sales and purchase contracts were also studied and revised by a professional lawyer to evaluate their legality and compare them to other sales contracts. Higher integration of these settlements into the regular housing market led to an increase in the production of housing units and negatively impacted housing sales (here referred to as "exchanges") which did not fully cover fraudulent and defective products (ex: the sale of the same unit to multiple customers, faulty wiring, plumbing…) due to the wording of the contract favoring the developer often while the buyers signed the contract without reading it since they relied on what their friend and neighbors did and ultimately produced worse conditions for buyers and developers. The study had several recommendations. The first one relates to more control over market operations during conception and implementation. The second one relates to the recommendation of the third-party overview on the housing exchange process. The third one recommends more support to the buyers in the form

of legal and architectural counseling on the contracts and the quality of construction and to Developers in the form of facilities trading forward payments across clients to prevent developer bankruptcy. The final one recommends the strengthening of arbitration and dispute resolution to improve the market's performance.

Ladki et al. (2008) assessed the real estate market through a content analysis study of classified real estate advertisements in Lebanon and used data between the years 2001-2008. They concluded that political factories did not severely hinder the growth of the real estate sector as prices and demand continued to rise. In addition, they observed the effect of seasonality on real estate which affected demand everywhere except in Beirut. They also concluded that there is risk linked to the current situation, however, it was a calculated risk.

Tierney (2017) wrote a dissertation on Lebanon's real estate, political and economic situation. In her dissertation, she states that the Lebanese political economy is structured around investments in real estate (by the Lebanese working abroad and Gulf nationals) and direct deposits in banks made by the Lebanese youth working abroad. She also concluded that the main export of Lebanon is its youth which is bad in the long term as skilled labor is crucial for the development of any society.

2.11. Conclusion

Overall, several variables and factors affect house prices in a given economy. The most common of which is personal income employment rates and unemployment rates which were a recurring variable in studies done in China, the USA, New Zealand, and most European nations. Interest rates were also prevalent in Australia, New Zealand, and South Korea in addition to China, the USA, the UK, and other developing and developed economies. Finally, the major local stock

market indexes were important in assessing the prices of houses in countries like the USA, UK, and the Netherlands to a major extent and in countries like France and Germany to a minor extent. In the case of Lebanon, however, scientific studies on the housing market are scarce which emphasizes the need for this research.

The next chapter will cover the models and methodology to be implemented to answer the different research questions. Also, a summary description of the data will be done. Data involves the average house prices, average and median income, unemployment rates and budget and trade deficits, etc. for Lebanon, France, the UK, Arizona, California, New York, Texas, and Tennessee. The data will then be run in an ARDL model whereby equations will be drawn based on the data in France, US states, and the UK where average and median house prices are the dependent variables and the other mentioned variables are the independent variables which means that the research is reliant on secondary data collected from the websites of the respective databases and sources. Then, the same equations will be implemented on the Lebanese housing market with the Lebanese variables and estimate the real and fair price of houses in Lebanon and compare it with the current average price.

Chapter 3: Procedures and Methodology

The purpose of this chapter is to discuss the research methodology to be used in the thesis. It will start by describing the research philosophy and reasoning approach. Then, the research questions and the hypotheses will be formulated. Data and variables will be explained, and finally, the model used will be elaborated. The variables will then run in an ARDL model and the results will be presented and interpreted in the following chapter.

3.1. Research Philosophy

A research philosophy describes the way data on a phenomenon should be gathered, analyzed, and used. The main four business and management research philosophies are positivism, pragmatism, realism, and interpretivism (Saunders, Lewis, & Thornhill, 2012). They will be discussed separately in the next sub-sections.

3.1.1. Positivism Philosophy

Positivism philosophy relies on quantifiable, measurable, and unbiased data. It adheres to the view that "factual" knowledge can only be gained through observation. The role of the positivist is only limited to data collection and interpretation objectively. Moreover, the positivist is somewhat independent of the study as there is no room for human provisions. In short, studies based on the positivist paradigm are focused solely on facts and consider the world as objective and external (Saunders, Lewis, & Thornhill, 2012).

3.1.2. Pragmatism Philosophy

Pragmatism philosophy revolves around the idea that there is no one single, ultimate way of interpreting the world but multiple realities. Each pragmatist can study the research question in a

unique manner and from a different point of view. Pragmatists often combine both positivism and interpretivism (discussed in section 3.1.4), therefore, the research methodology can be a combination of qualitative, quantitative, and action research methods. It is worth noting that pragmatists are not obliged to use multiple methods; rather they use a method or combination that best advances their specific research in the most positive manner (Saunders, Lewis, & Thornhill, 2012).

3.1.3. Realism Philosophy

Realism philosophy focuses on the notion of the independence of reality from the human mind. It branches into two opposing paths: direct and critical. In direct realism, the world is portrayed through the human senses. Whereas in critical realism, sensations and images of the real world experienced by human senses can be deceptive and don't portray the real world. Direct realists accept the world as one level while critical realists believe in a multi-level world (Saunders, Lewis, & Thornhill, 2012).

3.1.4. Interpretivism Philosophy

Interpretivism philosophy is based mainly on a naturalistic approach to data collection such as interviews and observations (or primary data collection) and it can also rely on secondary data. The meanings in this methodology tend to emerge towards the end of the research process. The most noteworthy variations include hermeneutics, which is the philosophy of understanding and interpreting; phenomenology which involves directly experiencing the phenomenon; and symbolic interactionism which revolves around the fact that certain symbols provide how reality is constructed (Saunders, Lewis, & Thornhill, 2012).

This thesis will adopt the positivist approach since it revolves around collecting data and reaching conclusions in an unbiased and neutral environment. Therefore, the findings of the thesis will be objective.

3.2. Reasoning Approach

An individual's ability to reason is that person's ability to apply logic and validate information acquired, make sense of it, and either justify or alter thoughts, beliefs, and practices based on the information the person has at that time (Walton, 1990).

The process of deductive reasoning, also known as the top-down approach, consists of drawing a conclusion that is based on multiple arguments that are commonly presumed to be truthful or legitimate. Through deductive reasoning, individuals assume that the set of premises is truthful, and consequently, the conclusions that arise from these valid premises must, in turn, produce legitimate truthful conclusions (Walton, 1990).

Inductive reasoning or the bottom-up approach, however, gathers observations in the form of premises and then reaches a general conclusion from the particular observations. When using inductive reasoning, individuals can make several observations and derive a generalized conclusion based on these observations (Heit, 2000)

The overall research methodology involves quantitative classifications based on data collected from various databases and similar previous studies conducted on the same subject but for different economies. In this thesis, a deductive reasoning approach will be used combined with inductive reasoning since the whole purpose of the thesis is to deduce whether the factors affecting the housing prices in Lebanon by running an ARDL model.

3.3. Research Questions and Hypotheses

In chapter 2, we discussed the multiple variables that affect house prices in different economies around the world. The most important of these variables include unemployment rates, interest rates on housing loans, money supply, income, CPI, and housing supply. We will also take into consideration non-resident deposits and the coincident indicator. Despite the presence of numerous studies on the matter in several nations, there is no study concerning this subject in Lebanon as the preceding literature on Lebanon is not scientific enough.

To pioneer in Lebanon, this study tackles two research questions that will be translated into a null and an alternative hypothesis. According to Toledo et al. (2011), a hypothesis is a contribution to the solution of the research problem. The null hypothesis (H_0) holds no statistical significance between the variables while the alternative (H_1) states the opposite. The research is true when the null hypothesis is rejected and the alternative accepted.

The preliminary belief for writing this thesis is due to the fact that in Lebanon the price of a house as compared to the average income (also referred to as the price/income ratio) is astronomical, especially when compared to that of developed nations like the USA, France, and the UK to name a few. It is even more shocking when considering that Lebanon lacks basic infrastructure that is taken for granted in the developed nations such as access to high-speed internet, 24/7 home utilities, and proper asphalt on major Lebanese roads long before the 2019 financial crisis hit. To further investigate this phenomenon, the following research questions and their corresponding hypotheses are used:

Research Question 1: What are the parameters affecting home prices in Lebanon?

Research Question 2: What are the short-run and long-run impacts of these parameters?

Research Question 1: The first objective of this research is to identify the parameters that affect Lebanese house prices. To do this, we look back at previous similar studies done in different nations. The following variables were common in most studies: Unemployment rates, money supply, inflation, and interest on housing loans. The thesis will also incorporate two other unique variables which are deposits by non-residents and Lebanon's coincident indicator. These were chosen since non-resident deposits represent most of the investment in Lebanon and the coincident indicator changes with the overall economic situation. In other words, the coincident indicator represents the overall health of the economy. All these variables will be run in an ARDL model to measure the degree to which these variables affect house prices in Lebanon. The following hypotheses are used to answer this question:

$H1_0$: These variables do not affect Lebanese house prices.

$H1_1$: These variables affect Lebanese house prices.

Research Question 2: To answer the second research question, we analyze the short-run and long-run effects of each variable on average house prices and see which variables have a short-run and which ones have a long-run effect on house prices in Lebanon.

3.4. Data and Variables

3.4.1. Sample and Data Sources

When it comes to the data, there are two types of data that researchers consider: primary and secondary. Researchers choose the type based on the nature of the study being conducted. Primary data is data that is gathered directly by the researcher and or a delegated party and collected

specifically for the study. Secondary data, however, is data that has been previously collected by another party for a different purpose and can be retrieved from a database.

The gathering procedures differ between these two types of data. Primary data can be collected through experimentation or observation or direct communication with respondents through interviews and /or questionnaires. The disadvantage of primary data collection is that it is both time and resource-consuming. Secondary data, however, is data that has been collected and analyzed by someone else. It can be published (government databases, journals, books, magazines, reports, public records, etc.) or unpublished (diaries, letters, unpublished biographies, autobiographies, etc.). Researchers must be cautious when using this type of data as it might be unsuitable or inadequate (Kothary,2004).

Due to the nature of this thesis, the data utilized will be secondary data retrieved from various online databases, the most notable being BLOM bank's BRITE database as it is a reliable and trustworthy database. BRITE collects data in partnership with Economena Analytics and Moody's Analytics with data from over 50 private and public sources covering virtually every sector of the Lebanese economy.

To make sure that the study is thorough, data is monthly from the second half of the year 2013 until February 2021. This will ensure that the most observations possible will be taken to improve the accuracy of the study.

3.4.2. Variables

According to Trochim & Donnelly (2006), variables are "any entity that can take on different values". They can be quantitative (measurable) or qualitative (dependent or independent). The independent variables will be regressed to test their effects on the dependent variable with the

control variables remaining constant throughout the regression. As mentioned previously, the variables were taken from previous studies mentioned in chapter 2.

3.4.2.1 Dependent Variable

In this thesis, the dependent variable should be house prices. However, we faced some limitations regarding this figure, given no direct data collected in Lebanon for median house prices or average house prices either. However, the BRITE database reports data on the number of real estate transactions and the cumulative value of real estate transactions. Thus, the average house price (AHP) was calculated using the following formula: Average House Price (AHP) = Value of real estate transactions / Number of real estate transactions.

3.4.2.2 Independent Variables

The independent variables are variables that affect the changes in the dependent variable. Since the objective of this thesis is to find the determinants of the average house price in Lebanon, the independent variables are unemployment rates, interest on house loans, construction permits, CPI, Deposits by non-Residents, and the coincident indicator. Although money supply data was available, this variable was excluded for two reasons: (i) it was found to be an I2 variable even when performing first difference (ADF test statistic = -2.16; $p = .222$ and ADF test statistic = -2.87; $p = .053$) and (ii) it has a high correlation with non-resident deposits ($r = .85$, $p < .001$).

However, due to data availability, we had to slightly change some variables. For example, unemployment rates and average monthly income are measured on an annual basis. Given the low number of observations that we had, we required a monthly proxy which is the Purchasing Manager's Index: employment Index (EI) which will be discussed later in this chapter. Moreover, we had two figures regarding interest rates on loans which are interest rates on LBP loans and

interest rates on USD loans. This is because private banks (excluding Banque de L'habitat) issue housing loans in USD while Banque de L'habitat, which is a major player in housing loans in Lebanon, issues loans in LBP. Therefore, both interest rates are applied at the first stage, before deciding which variable to keep at a later stage. Furthermore, the coincident indicator and non-resident deposits are unique variables in that they were not previously applied in previous studies. They are proxies to stock market indexes and will be discussed later on in the following section. Finally, construction permits will represent the supply of housing since there is no data on existing housing inventory to be found in Lebanon.

- **Employment Index:** It is very important to take Unemployment into account as employed people draw incomes that can be used to purchase homes and in turn, increase the house prices due to increased demand. Benamraoui (2018) noticed a negative correlation between unemployment and house prices (basically a positive correlation between employment rates and house prices). Also, Bork and Moller (2018) concluded that employment and income are some of the most important predictors of house prices as they have a significant impact on them. In 2013, Li and Chand concluded that house prices in China were affected by disposable household income as there is a strong positive correlation. Li et Al. (2018) also concluded the same thing concerning disposable income and house prices in China. The notion of income is true in other nations as well. In 2004, McCarthy and Peach concluded that house prices in the US have increased due to an increase in household income. Later in 2013, Algieri confirmed this in a study of his own not only for US markets but also for the UK, Spain, and the Netherlands, household income affected house prices in all these nations.

However, unemployment rates and mean income are only available on an annual basis. Therefore, the thesis will use a proxy called the Purchasing Manager's Index: employment Index (EI). EI is an appropriate proxy as it represents the actual income generated by employed citizens in the workforce. Data will be retrieved from the BRITE database for Lebanon. Given the positive relationship between employment and house prices, we can assume the same for the case of Lebanon in the short run and the long run.

Hypothesis 1: The employment Index positively affects housing prices in Lebanon.

- **Interest Rates:** The second and third independent variables are the interest rate on house loans issued in LBP and the interest rate on loans issued in USD. These are important variables since, in modern times, most houses are purchased with a mortgage. This has led many researchers to use the interest rate as a variable in their studies. An increase in interest rates will increase the cost of borrowing, discouraging potential buyers from taking loans. As a result, housing demand will fall. Li et al. (2018) concluded that an increase in interest rates will result in a decrease in house prices in China. Also, in 2011 Rubio concluded that an increase in interest rates on housing loans in the US will lead to a decrease in house prices. In 2018, Bork and Moller concluded that interest rates are one the important predictors of house prices in the US. Benamraoui (2018) also spoke about the significance of interest rates on house prices both in the US and UK as they were highly correlated. Lim and Tsiaplias (2018) concluded that interest rates increase house prices in Australia. However, they also concluded that there is a threshold interest rate below which house prices increase in an unstable manner. However, due to the lack of availability of interest rates specific to loans, the thesis will use two proxy variables which are the weighted average lending rate on LBP accounts and the weighted average lending rate on USD

accounts. Data for these variables will be taken from the BRITE database for Lebanon. We expect a negative relationship between interest rate and house prices in the short run and the long run.

Hypothesis 2: Interest rates negatively affect housing prices in Lebanon.

- **Construction Permits:** The fourth variable is construction permits (COP) which is another factor affecting house prices as it is considered a proxy of housing supply in the Lebanese market. After all, housing price is a representation of demand and supply. Therefore, the higher the supply, the less a price can be charged assuming constant demand. Wang and Rickman (2020) studied the effect that the supply of housing had on the price of housing in China. The supply was proxied mainly by land cost and existing housing inventory. Their study concluded that as land supply increases, the price does not increase and population growth increases. The findings of Borowiecki (2009) confirm an inverse relationship between housing supply and house prices. The increase in supply will put downward pressure on house prices. Due to the lack of monthly data for housing completions, construction permits will be used as an indicator of housing supply. Data for this variable will be taken from the BRITE database for Lebanon. Given the laws of demand and supply, we can assume that as construction permits increase in Lebanon, the average house prices in Lebanon should decrease both in the long run and the short run.

  Hypothesis 3: Construction Permits negatively affect housing prices in Lebanon.

- **CPI:** The fifth variable will be the consumer price index (CPI). This is a general index that is calculated using the prices of a basket of basic goods and is used to measure inflation over time by taking 100 as the basis. Inflation is expected to drive the housing upward for two main reasons: (i) an increase in inflation will increase construction costs, which will

be translated into higher prices; (ii) an increase in inflation will generate an increase in housing investment motives, as house ownership is considered an important investment alternative. The increase in housing demand will push housing prices upward. In times of uncertainty, investors might prefer higher exposure to real estate as the latter offers protection against inflation and has a low correlation with other financial assets. Algieri (2013) used the inflation rate in his study on house prices across several countries in the EU. The study concluded that a 1% increase in inflation leads to an increase of 1.6% in the house prices in the Netherlands, 1.97% in the UK, 1.1% in the USA, 0.64% in France, 0.3% in Spain, and 0.13% in Germany and Italy. It also concluded that inflation had a positive correlation with house prices. Apergis (2003) found that mortgage rates and inflation rates have the highest and the second-highest explanatory power over the variation in real house prices in Greece. Inflation, in this paper, will be measured by CPI. Data for this variable will be retrieved from the BRITE database. We expect a positive relation between CPI and house prices in Lebanon in the short run and the long run.

Hypothesis 4: Inflation positively affects housing prices in Lebanon.

- **Deposits by Non-Residents:** The sixth variable is deposits by non-residents made by the Lebanese people working outside Lebanon into banks in Lebanon. In fact, in 2013, Kanj and El Khoury argued that non-resident deposits amounted to nearly 20% of total bank deposits in Lebanon in January 2013 and more than 80% of them were made in foreign currency. They also stated that government debt was financed by Lebanon's banking sector. Therefore, there is no doubt that this is an important driver for the Lebanese economy as it is the main source of Lebanon's foreign currency inflow and the main funder of the government's budget deficit. Data for this variable will be retrieved from the BRITE

database. Given that this variable is unique to Lebanon and represents a direct outside inflow of money into the economy and how it represents part of the foreign investment factor, we can assume that it will have a positive impact on house prices in Lebanon in both the short and long run.

Hypothesis 5: Non-resident deposits positively affect housing prices in Lebanon.

- **Coincident Indicator:** The seventh variable is the coincident indicator which according to BDL is a basic monthly approximation to GDP. It is calculated using the following eight economic variables: Electricity production (18.6%), oil derivative imports (18.2%), cement deliveries (16.5%), cleared checks (12%), money stocks M3 (12%), foreign trade (11.8%), passenger flows (11%). It is believed that these variables represent Lebanese economic activity (Jad, 2010). The strong relationship between GDP and the housing market has been examined in the literature. Adams and Füss (2010) noticed that GDP growth has a positive impact on housing prices. While many studies agree that a strong short-term relationship exists between GDP and housing prices, Madsen (2012) argues that the long-term relationship is weaker. It is expected that higher economic growth will improve the affordability of a potential housing purchase, pushing the housing prices up. As mentioned before, due to the lack of monthly data for GDP, the coincident indicator will be used as a proxy for economic conditions. Data for this variable will be taken from the BRITE database. Thus, there should be a positive correlation between coincident indicators and house prices in Lebanon.
- *Hypothesis 6: Coincident indicator positively affects housing prices in Lebanon.*

All variables are in natural logarithm form as advocated by Khan and Ross (1977). According to them, a regression using log variables allows the dependent variable to react proportionally to a change in the regressors.

3.5. Correlation

Before including all variables into our model, we run a correlation matrix to check the problem of multicollinearity. The correlation matrix in Table 1 revealed that there was an extremely high positive correlation between USD interest rate and LBP interest rate; $r = .88$, $p < .001$, suggesting the need to remove one of the two variables. To decide on which variable to remove, we check its correlation with our dependent variable. We found that USD interest rate is correlated with average housing price ($r = .14$, $p < .05$), while LBP interest rate is less related to average pricing price ($r = .06$, $p > .05$). Thus, in our analysis, we proceed by using USD interest rate rather than LBP interest rate as our proxy for interest rate.

Furthermore, the correlation matrix revealed an extremely high negative correlation between coincidence indicator and consumer price index; $r = -.91$, $p < .001$, suggesting the need to drop one of them. Thus, we decided to run ARDL using either one of the two variables; the choice of the variable to keep was based on ARDL output and the stability of the model obtained. The inclusion of the coincident indicator in our regression model yielded an unstable model, based on the CUSUM square. However, when performing the ARDL model with the consumer price index and without the coincidence indicator, the CUSUM squared revealed that the model was stable (Appendix 1). As such, we proceed by removing the coincidence indicator from the final model.

As such, the final model of the study contained the following variables: The Average House Pricing as the dependent variable and the USD interest rate, non-resident deposits, consumer index, construction permits, and employment index as independent variables.

Table 1: Correlation Matrix

	LCOP	LCPI	LEI	LNR	LUSD	LBP	LAHP
LCOIN	0.24	-0.91	0.20	0.52	0.15	0.23	-0.50
LCOP		-0.23	0.18	-0.17	-0.43	-0.40	-0.24
LCPI			-0.29	-0.26	-0.01	-0.02	0.47
LEI				-0.23	-0.30	-0.29	-0.31
LNR					0.66	0.78	-0.13
LUSD						0.88	0.14
LLBP							0.06

3.6. Regression Model

In this section, we will discuss in detail the regression model used and investigate the impact of the independent variables on the dependent variable. Various regression techniques can be employed depending on the number of variables and the nature of the study. In line with Alexiou and Vogiazas (2019) and Bahmani-Oskooee and Ghodsi (2016), this thesis will draw the equations using the Autoregressive Lag Distribution (ARDL) model will be used. Given the nature of the thesis, several independent variables need to be tested for long-run relationships, in this case, the relationship between house prices in Lebanon (dependent variable) with the number of construction permits (COP), consumer price index (CPI), employment index (EI), non-resident deposits (NR) and interest on USD loans in Lebanon as the independent variables. The ARDL cointegration approach was developed by Pesaran (1997), Pesaran and Shin (1999), and Pesaran et al. (2001). It has several advantages over other cointegration methods such as Engle and Granger (1987) and Johansen and Juselius (1990) procedures such as:

- The ARDL method can be applied whether the variables under the study are integrated of the same order or not, while Johansen cointegration techniques require that all the variables in the system be of equal order of integration. This means that the ARDL method can be applied when underlying variables are integrated of order one, zero, or fractionally integrated.
- The ARDL test is relatively more efficient in the case of small and finite sample data sizes (which is the case for this thesis) while the Johansen cointegration techniques require large data samples for validity.
- The ARDL methodology can yield estimates and valid t-statistics even when autocorrelation and endogeneity are present (Harris and Sollis, 2003).
- An error correction model (ECM) can provide both short-run coefficients and long-run equilibrium without losing valid long-run coefficients.
- Finally, the ARDL model can have an equal number of lag lengths for all the variables or different lag orders without affecting the asymptotic distribution of the test statistic (Pesaran et al., 2001).

In its basic form, an ARDL regression model (p,q) can be expressed as:

$$\beta(L)\, Y_t = \lambda + \alpha(L)\, x_t + \varepsilon_t$$

where L is a distributed lag component and ε_t is a random disturbance term that will be serially independent. The model is autoregressive because Y_t is explained by its lagged value of itself. It also has a distributed lag component, in the form of successive lags of the x explanatory or independent variable. The ARDL (p, q) model can be estimated by applying the ordinary least

squared (OLS) method. This estimation will yield biased coefficient estimates due to the presence of lagged values of the dependent variable as regressors. If the disturbance term $\mathcal{E}_t$ is autocorrelated, the OLS will also be an inconsistent estimator, and in this case, instrumental variables estimation will be more useful for this model (Giles, 1975, 1977). The methodology that this article consists of the following steps:

3.6.1. Unit Root Test

First, we must perform a unit root test. There are several methods to perform a unit root. Since these methods may give different results, we selected the Dickey-Fuller (ADF) test (1979, 1981). In this test, the null hypothesis is that the variable contains a unit root, i.e., it is not stationary. The optimal lag includes lags sufficient to remove any serial correlation in the residuals. The ARDL bounds test is based on the assumption that there are I (0) or I (1) variables, but anything beyond the I (1) series invalidates the calculated F-statistic (Ouattara, 2004). Therefore, before running the ARDL model, we must determine the order of integration of all variables using unit root tests. The main objective is to ensure that there are no I (2) variables to avoid spurious results since interpreting the values of F-statistics provided by Pesaran et al. (2001) and Narayan (2005) becomes impossible.

3.6.2. Optimal Lag

Second, a particular type of ARDL model called unrestricted error correction model (ECM) or "conditional ECM" is formed according to Pesaran et al. (2001). Before the estimation of the model, we must determine the appropriate lag structure for this using the pre-estimation version

of Eviews called lag length criteria in Vector AutoRegression (VAR). As shown by Nielsen (2001), this lag-order selection statistics can be used in the presence of I(1) variables. The long-run formula is expressed as follows:

$$\boldsymbol{LAHP_t = \alpha_0 + \sum_{i=1}^{l_1-1} \theta_{1i} \Delta LCOP_{t-i} + \sum_{i=1}^{l_2-1} \theta_{2i} \Delta LCPI_{t-i} + \sum_{i=1}^{l_3-1} \theta_{3i} \Delta LEI_{t-i} + \sum_{i=1}^{l_4-1} \theta_{4i} \Delta LNR_{t-i} + \sum_{i=1}^{l_5-1} \theta_{5i} \Delta LUSD_{t-i} + \varphi_1 LAHP_{t-1} + \varphi_2 LCOP_{t-1} + \varphi_3 LCPI_{t-1} + \varphi_4 LEP_{t-1} + \varphi_5 LNR_{t-1} + \varphi_6 LUSD_{t-1} + \varepsilon_{it}} \quad \textbf{Equation 1}$$

Where the L=Lag operator, Δ is the first difference, $\theta_{1i}, \theta_{2i}, \theta_{3i}, \theta_{4i}, \theta_{5i}$ and $\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5, \varphi_6$ represent the short- and long-run coefficients, respectively.

3.6.3. Diagnostic Tests

Third, we use the Breusch-Godfrey Serial Correlation LM test to test the null hypothesis that the errors are serially independent, against the alternative hypothesis that the errors are AR(m) or MA(m). The errors of the estimated model must be serially independent. As Pesaran et al. (2001) note, this requirement may also be influential in our final choice of the maximum lags for the variables in the model.

The existence of serial independence alone does not necessarily mean that the model is stable. Therefore, Pesaran and Pesaran (1997) and Pesaran et al. (2001) proposed testing for stability using Brown et al. (1975) tests, which are known as the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ) (Stamatious and Dritsakis, 2014). If the plots on the CUSUM and CUSUMSQ graphs stay within the 5 percent critical bounds level of significance, then the null hypothesis of all coefficients in the given regression is stable and cannot be rejected. Finally, we test for the normality of the residuals to determine whether or not there is a statistical inference of the ARDL coefficient estimates. This is done using the Jarque-Bera test (1980) which tests for

skewness and kurtosis. The null hypothesis of the test is that the residuals are normal and are met when the p value> 0.05 is significant at 5 percent.

3.6.4. Bound Testing

Fourth, the Bound testing is performed. The F test is used for testing the absence of a long-run equilibrium relationship between the variables. This absence coincides with zero coefficients for the lagged levels of the dependent variable. A rejection of the null hypothesis implies that we have a long-run relationship. When a long-run relationship exists, the F test indicates which variable should be normalized. The F-test has a non-standard distribution which depends on (i) whether variables included in the model are I (0) or I (1), (ii) the number of regressors, and (iii) whether the model contains an intercept and/or a trend. The test involves asymptotic critical value bounds, depending on whether the variables are I (0) or I (1). In each case, the lower bound is based on the assumption that all of the variables are integrated of order zero, and the upper bound is based on the assumption that all of the variables are integrated of order one. If the computed F-statistic falls below the lower bound, then we would conclude that the variables are I (0) and that no cointegration is possible. If the F-statistic exceeds the upper bound, then we conclude that we have cointegration and if it lies between the bounds, the test is inconclusive.

3.6.5. Long-run Relationships

Fifth, assuming that the bounds test leads to the conclusion of cointegration, we estimate the long-run relationships between the variables using the following equation:

$$\boldsymbol{LAHP_t = \alpha_0 + \varphi_1 LAHP_{t-1} + \varphi_2 LCOP_{t-1} + \varphi_3 LCPI_{t-1} + \varphi_4 LEI_{t-1} + \varphi_5 LNR_{t-1} + \varphi_6 LUSD_{t-1} + \varepsilon_{it}} \quad \textbf{Equation 2}$$

Where L=Lag operator and $\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5, \varphi_6$ represent the long-run coefficients

3.6.6. Short-run Relationships

The existence of cointegration derived from the above model does not necessarily imply that the estimated coefficients are stable. Therefore, Pesaran and Pesaran (1997) and Pesaran et al. (2001) proposed assessing parameter stability in estimated models using Brown et al. (1975) tests, which are known as the cumulative sum (CUSUM) and as the cumulative sum of squares (CUSUMQ) (Stamatious and Dritsakis, 2014). If the plots of the CUSUM and CUSUMSQ statistics stay within the critical bonds of a 5 percent level of significance, the null hypothesis of all coefficients in the given regression is stable and cannot be rejected. To ensure the goodness of fit of the model, diagnostic and stability tests are conducted. Diagnostic tests examine the model for serial correlation, non-normality, and heteroscedasticity.

The equation used to estimate the short-run will be estimated as follows:

$$\boldsymbol{LAHP_t = \alpha_0 + \sum_{i=1}^{l_1-1} \theta_{1i}\, \Delta LCOP_{t-i} + \sum_{i=1}^{l_2-1} \theta_{2i}\, \Delta \mathrm{L}CPI_{t-i} + \sum_{i=1}^{l_3-1} \theta_{3i}\, \Delta \mathrm{LE}I_{t-i} + \sum_{i=1}^{l_4-1} \theta_{4i}\, \Delta LNR_{t-i} + \sum_{i=1}^{l_5-1} \theta_{5i}\, \Delta LUSD_{t-i} + \beta_1 ECM_{t-1} + \epsilon_t} \quad \textbf{Equation 3}$$

Where L=Lag operator and $\theta_{1i}, \theta_{2i}, \theta_{3i}, \theta_{4i}, \theta_{5i}$ represent the short-run coefficients

In the last step, after the long-run relationship between variables, the direction of causality using the ECM-ARDL model is analyzed.

Chapter 4: Findings

This chapter provides the empirical results needed to answer the research questions. It starts by describing the data, followed by the assumptions of the ARDL model, and then reporting the long-term and short-term findings regarding the factors affecting the housing prices in Lebanon.

4.1. Descriptive Statistics

Table 2 below depicts the descriptive statistics (Mean, Standard Deviation, Minimum, Maximum, Standard Deviation, Skewness, and Kurtosis) of the variables used in the study including both independent variables (Consumer Price Index-CPI, employment index-EI, non-resident deposits-NR, lending rate on USD-USD, construction permits-COP), and the dependent variable (average housing price). All tests are performed using EVIEWS version 10. The mean "average' is the sum of the observations divided by the number of observations. The median is the middle value in an ascending or descending sorted list of observations. The standard deviation measures the extent to which the scores are clustered or dispersed around the mean. Looking at skewness, two variables are normally distributed with a skewness ranging between -0.5 and 0.5. More specifically, EI and NR have a value of 0.22 and 0.01 respectively. However, AHP, CPI, and USD are positively skewed with a skewness of 1.05, 2.38, and 1.45 respectively. The variable COP is negatively skewed with a skewness of -2.71. According to Jarque-Bera tests, all variables are not normally distributed with p-values less than 0.01 for all variables, except for NR with a probability of 0.098.

Table 2: Descriptive Statistics

	AHP	CPI	EI	NR	USD	COP
Mean	11.82	4.73	3.91	10.56	2.03	7.06
Median	11.80	4.61	3.90	10.56	1.98	7.15

Maximum	12.54	5.80	3.95	10.76	2.35	7.68
Minimum	11.37	4.55	3.87	10.34	1.89	5.02
Std. Dev.	0.16	0.31	0.01	0.12	0.12	0.37
Skewness	1.05	2.38	0.22	0.01	1.45	-2.71
Kurtosis	6.78	7.22	4.63	1.90	3.98	13.37
Jarque-Bera	72.22	157.16	11.04	4.65	36.10	530.56
Probability	0.000	0.000	0.004	0.098	0.000	0.000
Observations	93	93	93	93	93	93

4.2. ARDL Preliminary Tests

4.2.1. Unit Root Test

Before running the ARDL model, it is important to analyze the order of integration of the variables considered. Although the ARDL method can be applied to time series data, irrespective of whether these variables are I (0) or I (1), it is necessary to check that none of the variables are I (2).

For the ARDL model, the assumption of stationarity is tested using the Augmented Dickey-Fuller test (ADF) (Dickey & Fuller, 1979). A time-series set of data is said to be non-stationary when it has a unit root. The null hypothesis of the ADF test states that the time series set of data is non-stationary. As such, the assumption of stationarity is assumed when the ADF test statistic is significant, i.e., the ADF test statistic is greater than the test critical value. Table 3 shows that for the ARDL model in this study, the assumption of stationarity is met the AHP (ADF test statistic = -5.59; $p < .001$) and the EI (ADF test statistic = -4.49; $p < .001$). Moreover, at the first difference, the ADF statistic is greater than the critical value for other variables, namely, the COP (ADF test statistic = -4.19; $p = .001$), the CPI (ADF test statistic = -3.39; $p = .003$), the NR (ADF test statistic = -3.74; $p = .005$) and the USD (ADF test statistic = -3.95; $p = .003$), indicating that the assumption of stationarity is met at first difference (Table 3). Results show that all variables are either I (0) or I (1) and none of them are I (2). More specifically, AHP and EI are I (0) since their p-values are

less than 0.01 and the remaining variables (COP, CPI, NR, and USD) are I (1) since the p-values are also less than 0.01. The outcomes that the variables are a mixture of I (0) and I (1) satisfy the condition for testing and using ARDL.

Table 3: Augmented Dickey-Fuller Unit Root Tests

Augmented Dickey-Fuller Test

Variables	Levels				First Difference			
	Constant	P-Value	Constant &Trend	P-Value	Constant	P-Value	Constant & Trend	P-Value
AHP	-5.59	0.000***	-10.51485	0.000***	-4.19	0.001***	-10.86434	0.000***
COP	-1.59	0.485	-6.529658	0.000***	-3.93	0.003***	-4.170264	0.0075***
CPI	1.46	0.999	-3.951604	0.0137**	-8.78504	0.000***	-4.581372	0.002***
EI	-4.49	0.000***	-8.84382	0.000***	-3.74	0.005***	-8.86044	0.000***
NR	-1.63	0.464	-4.591548	0.0019***	-3.95	0.003***	-4.874469	0.0008***
USD	-2.17	0.218	-3.800962	0.0209**	-4.19	0.001***	-3.947448	0.0139**

Note: *, **, and *** are significant at 10%, 5%, and 1%, respectively

4.2.2. ARDL Optimal Lag Length

After testing the unit root test of all variables to make sure that none of them are I (2), the second step is to determine the optimal lag length of our dependent variable, by running the normal unrestricted VAR. There are five different methods for obtaining the optimal number of lags: Likelihood Ratio (LR), Akaike's Final Prediction Error (FPE), Akaike Info Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn information Criterion (HQ). Table 4 illustrates our obtained results As such since all the VAR results except for SC show that the optimal lag is 3, we shall use 3 lags for this model.

Table 4: Var Lag Order Selection Criteria

Number of Lags	LogL	LR	FPE	AIC	SC	HQ
0	448.6102531	NA	1.93E-12	-9.946298	-9.778525	-9.878673

1	1071.968813	1148.661	3.58E-18	-23.14537	**-21.97095***	-22.67199
2	1137.71707	112.2892	1.86E-18	-23.81387	-21.63281	-22.93475
3	1192.954867	86.89092*	**1.24e-18***	**-24.24618***	-21.05849	**-22.96131***
4	1226.743502	48.59489	1.37E-18	-24.19648	-20.00215	-22.50587

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

4.2.3. Model Selection Criteria

The next step is to determine the best-fitted model for our series. Though the data is monthly data, given a small number of observations, the maximum lag length is set to four for the independent variables to accommodate all the lag effects. Increasing the lags will result in a loss of observations. The lower the (AIC value), the better the model; thus, the best ARDL model is the one with the lowest value of AIC. Results in Figure 1 show that ARDL (3, 3, 1, 3, 4, 3) is the best model as it has the lowest value of AIC. In other words, the best model has a lag of three for AHP, three for CPI, one for EI, three for NR, four for USD, and three for COP.

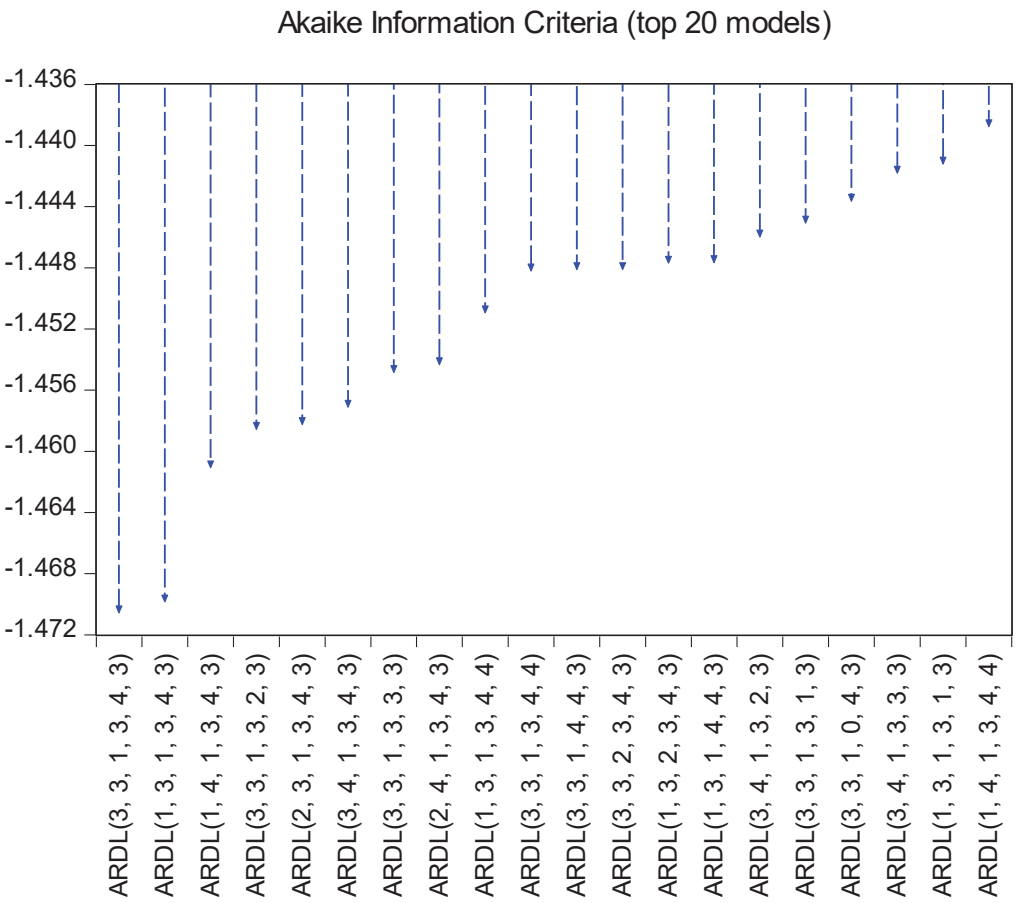


Figure 1. Akaike Info Criterion (Top 20)

4.3. Model Checking and Diagnostic Analysis

The ARDL model attempts to establish the Best Linear Unbiased Estimator (BLUE). To ensure that the ARDL model is BLUE, the model must meet the following assumptions:

4.3.1. Assumption of Stability

The ARDL model is very sensitive to structural breaks, especially since we are predicting the Average Housing Price in Lebanon using econometric indicators that are sensitive to unstable local, regional, and international events. Brown et al. (1975) claimed that the cumulative sum of the recursive residuals (CUSUM) and the cumulative sum of squared recursive residuals

(CUSUMSQ) can be used to assess the stability of the ARDL model. The CUSUM and CUSUMSQ are two graphs that plot the residuals updated recursively against the breakpoints. The criterion for the assumption of stability is that the plot of CUSUM and CUSUMSQ stay within the two parallel critical lines indicated by the 5% significance level. The CUSUM and the CUSUMSQ graphs below indicate that the assumption of stability was met (the plot of CUSUM and CUSUMSQ stayed within the two parallel critical lines indicated by the 5% significance level).

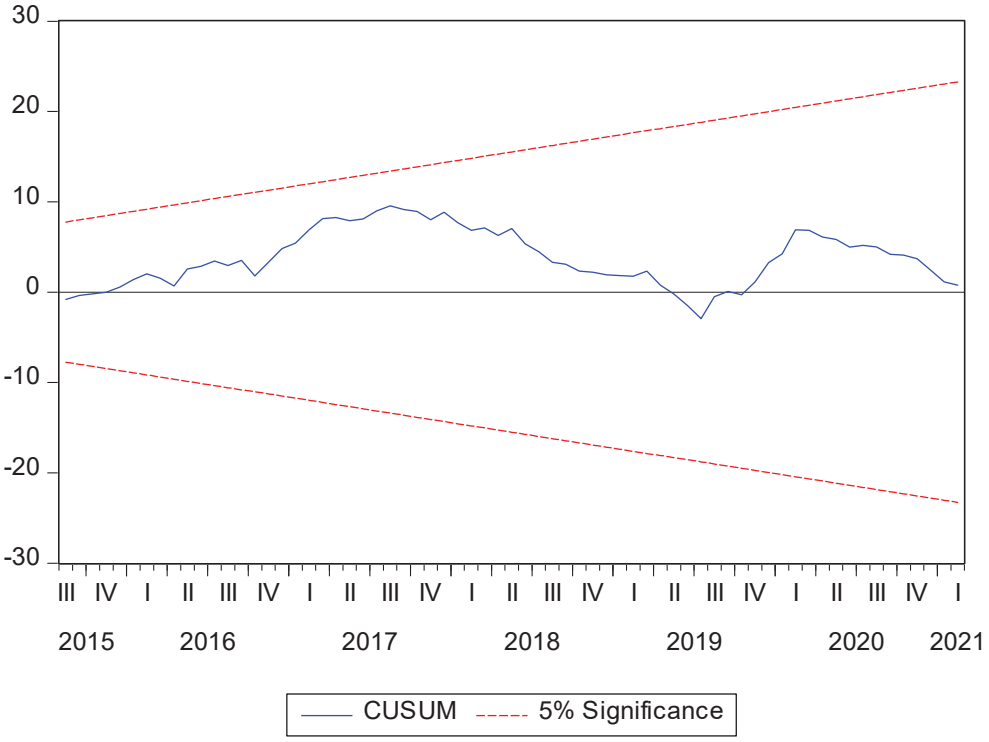


Figure 2. CUSUM- Long Run

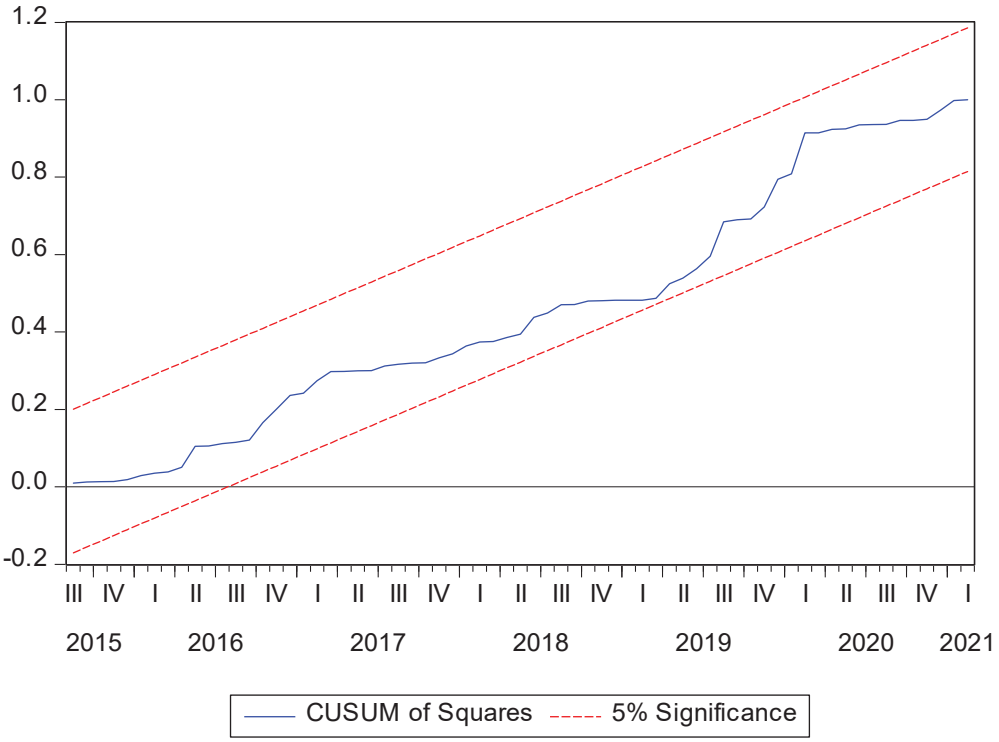


Figure 3. CUSUM Square- Long Run

4.3.2. Assumption of no Serial Correlation

The assumption of no serial correlation is tested using the Breusch-Godfrey Serial Correlation LM test. Serial correlation indicates that different lags of residuals are correlated. Although serial correlation does not affect the bias of the regression estimators, it directly affects the efficiency of the estimators (Brooks, 2014). For example, it may affect the standard errors of regression parameters which leads to drawing wrong inferences and invalidating the significance tests. The null hypothesis of the Breusch-Godfrey Correlation test states that there is no correlation in the ARDL model. As such, the assumption of no serial correlation is met when the Breusch-Godfrey test is not significant. For this study, Table 5 shows that the Breusch-Godfrey Serial

Correlation LM test was not significant; F (2, 66) = 0.108, p = 0.898, indicating that the assumption of no serial correlation is met.

Table 5: Breusch-Godfrey Serial Correlation LM Test

Assumption of No serial Correlation			
Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.108	Prob. F (2,66)	0.898
Obs*R-squared	0.295	Prob. Chi-Square (2)	0.863

4.3.3. Assumption of no Heteroscedasticity

The assumption of no heteroscedasticity tests whether the ARDL model residuals have constant variance (homoscedastic). If this assumption is not met, then the estimated coefficients will be biased and lead to invalid inferences. This assumption is tested using the Breusch-Pagan-Godfrey test which has the following null hypothesis; the residuals have constant variance (homoscedastic). As such, if the Breusch-Pagan-Godfrey statistic is not significant, then the assumption of no heteroscedasticity is met. For this study, Table 6 shows that the Breusch-Pagan-Godfrey was not significant; F (22, 66) = 1.474, p = .115, indicating that the assumption of no heteroscedasticity is met.

Table 6:Breusch-Pagan-Godfrey Heteroskedasticity Test

Assumption of No Heteroskedasticity			
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.474	Prob. F (22,66)	0.115
Obs*R-squared	29.319	Prob. Chi-Square (20)	0.136
Scaled explained SS	25.809	Prob. Chi-Square (20)	0.260

4.3.4. Assumption of Normality of Residuals

Normality of residuals is an essential assumption for the proper statistical inference of the ARDL coefficient estimates and hypothesis significance tests. Normality of residuals is tested using the Jarque-Bera test with the following null hypothesis: residuals are normal. As such, the assumption of normality of residuals is met when the significance level of the Jarque-Bera test is greater than .05. For this study, Figure 4 shows that the distribution of residuals had a *Jarque-Bera test statistic* =4.59, $p = 0.101$; indicating that the normality of residuals was met.

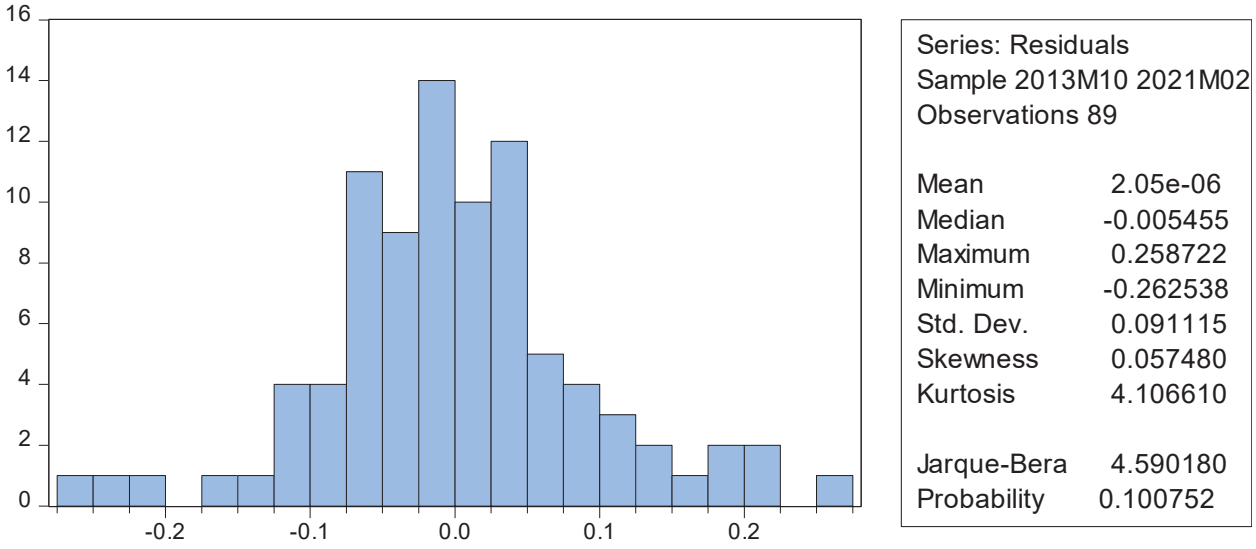


Figure 4. Residuals Statistics- Long Run

4.4. Analysis of Long-Run Relationships

The next step is to test for the existence of the long-run relationship between AHP and other regressors using the bound test approach. More specifically, the F-bound test is executed to investigate whether there exists a long-run relationship between the independent variables and the dependent variable (Average Housing Price). The F-bound test has a null hypothesis which states

that a long-run relationship does not exist. Duasa (2007) asserted that if the F-bound test statistic is greater than the critical value, then we can reject the null hypothesis, validating the presence of a long-run relationship. As per Table 7, the F-test indicated that there is a long-run relationship between the econometric indicators and Average Pricing in Lebanon. The F-value is 6.041, exceeding the upper bound (critical value = 4.21) at a 1% significance level, supporting the presence of a long-term relationship between AHP and the explanatory variables.

Table 7: Long-run Relationship

F-Bounds Test		Null Hypothesis: No levels of relationship		
Test Statistic	Value	Significance	I (0)	I (1)
			Asymptotic: n=1000	
F-statistic	6.041	10%	1.81	2.93
k	5	5%	2.14	3.34
		2.50%	2.44	3.71
		1%	2.82	4.21

EC = AHP - (0.2767COP -0.0576CPI + 2.0357EI + 0.1657NR + 0.1940USD)

Since the results of the Bound testing indicated the presence of a long-run relationship, we proceed by looking at the long-run coefficients. An independent variable is significant towards the dependent variable in the long run only when prob<0.05 which means it is significant at 5%. Table 8 shows that among all the independent variables, only the employment index (EI) could significantly explain the variation in AHP since it is the only variable whose prob <0.05. The higher the employment index, the more income is being accumulated over the years, which could be deployed towards house purchase, leading to a higher house price (accepting hypothesis 1). Thus, employment potentially affects housing prices in the long term by affecting housing demand. This is consistent with the inverse relationship between the unemployment rate and house prices

(Égert and Mihaljek, 2007; Adams and Füss, 2010). The employment rate was found to be the most important variable in explaining housing prices in Greece (Apergis and Rezitis (2003). It is worth mentioning that Construction permit has a positive impact, but are significant at only 10% (p = 0.0670).

Given that there is a proven long-run relationship between at least one independent variable and the dependent variable, the next step is to study the short-run significance of the independent variables on the dependent variable.

Table 8: Long-Term Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COP	0.276741*	0.148606	1.862248	0.0670
CPI	-0.057578	0.099116	-0.580919	0.5632
EI	2.035656***	0.603673	3.372120	0.0012
NR	0.165668	0.242836	0.682223	0.4975
USD	0.194024	0.421326	0.460510	0.6466

4.5. Analysis of Short Run Relationships and Speed of Adjustment

To begin the study of the short-run relation, we must re-establish that the model is stable, correlated, heteroscedastic, specific and that the residuals are normal before we proceed with the analysis.

4.5.1. Assumption of Stability

The first step is to determine whether the short-run model is stable by using the CUSUM and CUSUM square. The CUSUM and the CUSUMSQ graphs in Figures 5 and 6 respectively indicate that the assumption of stability was met (the plot of CUSUM and CUSUMSQ stayed within the two parallel critical lines indicated by the 5% significance level).

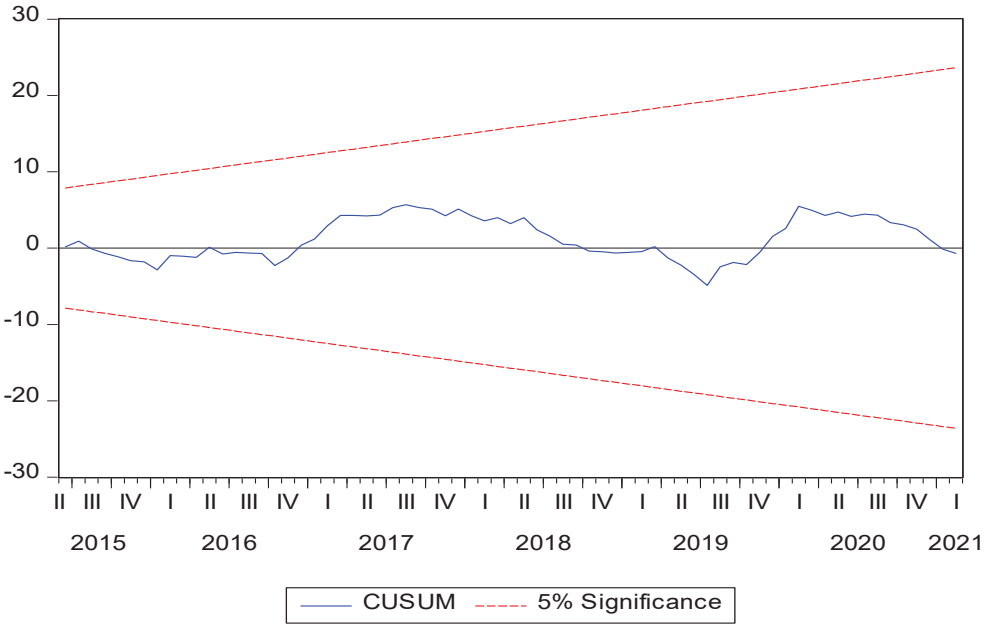


Figure 5. CUSUM- Short Run

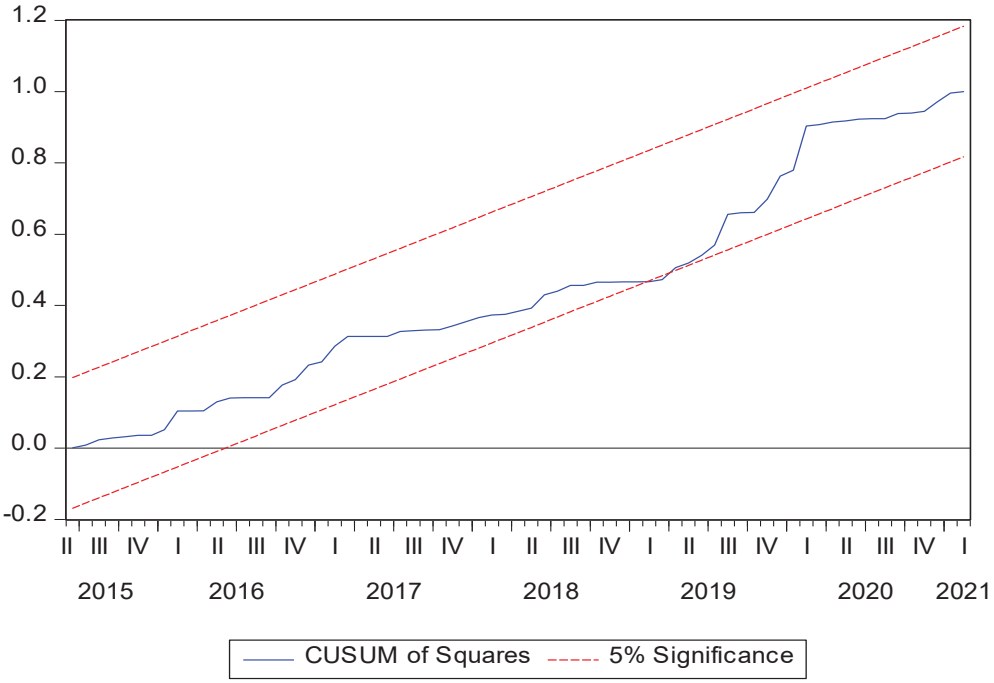


Figure 6. CUSUM Square- Short Run

4.5.2. Assumption of no Serial Correlation

The assumption of no serial correlation is tested again for the short run using the Breusch-Godfrey Serial Correlation LM test with the null hypothesis of the Breusch-Godfrey Correlation test stating that there is no correlation in the ARDL model. Therefore, the assumption of no serial correlation is met when the Breusch-Godfrey test is not significant. For this study, the Breusch-Godfrey Serial Correlation LM test was not significant as shown in Table 9; F (2, 67) = 0.245, p = 0.784 which is well above 5% (0.05), indicating that the assumption of no serial correlation is met.

Table 9: Breusch-Godfrey Serial Correlation LM Test for Short Run

Assumption of No serial Correlation			
Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.245	Prob. F (2,67)	0.784
Obs*R-squared	0.652	Prob. Chi-Square (2)	0.722

4.5.3. Assumption of no Heteroscedasticity

The next step is to test for heteroscedasticity (or lack thereof) by using the Breusch-Pagan-Godfrey test whose null hypothesis states that the residuals have constant variance (homoscedastic). Therefore, if the Breusch-Pagan-Godfrey statistic is not significant then the assumption of no heteroscedasticity is met. In the short run, the Breusch-Pagan-Godfrey was not significant in Table 10; F (20, 69) = 1.412, p = .147 which is above 5% (0.05), indicating that the assumption of no heteroscedasticity is met.

Table 10: Breusch-Pagan-Godfrey
Heteroskedasticity Test for The Short Run

Assumption of No Heteroskedasticity			
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.412	Prob. F (20,69)	0.147

Obs*R-squared	26.143	Prob. Chi-Square (20)	0.161
Scaled explained SS	24.439	Prob. Chi-Square (20)	0.224

4.5.4. Assumption of Normality of Residuals

As mentioned before, the normality of residuals is an essential assumption for the proper statistical inference of the ARDL coefficient estimates and hypothesis significance tests. It is tested using the Jarque-Bera test with the following null hypothesis: residuals are normal. As such, the assumption of normality of residuals is met when the significance level of the Jarque-Bera test is greater than .05. For the short run, the distribution of residuals had a *Jarque-Bera test statistic* =5.281, p = 0.07, as shown in Figure 7, which is above 0.05 indicating that the normality of residuals was met.

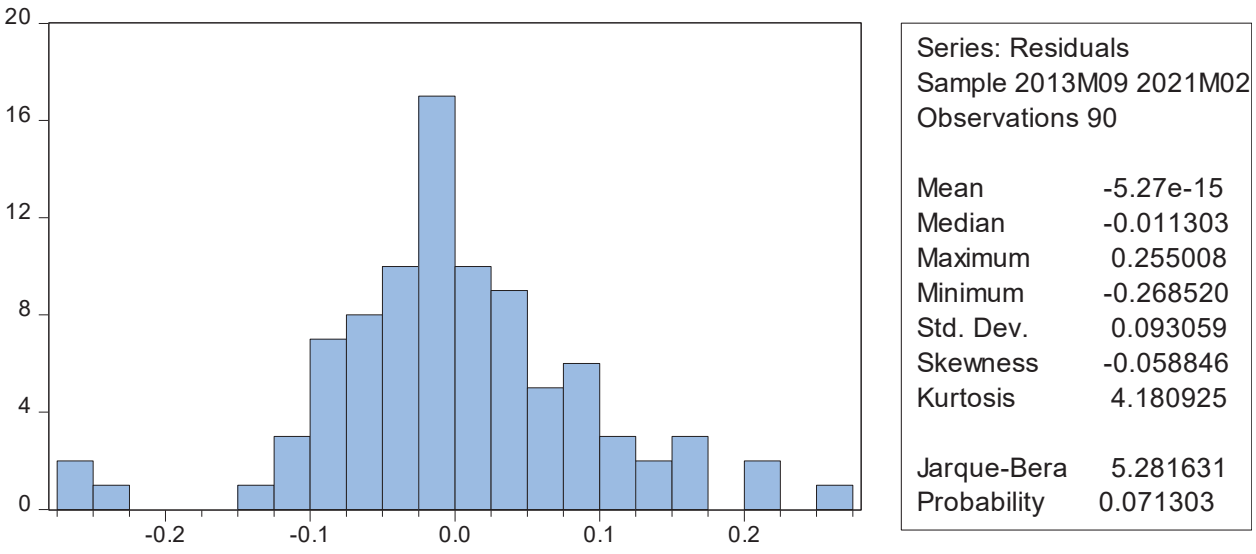


Figure 7. Residuals Statistics- Short Run

4.5.5. Analysis of Short-Run Relationships

As a final step, we proceed by examining the short-run association using the Error Correction Model (ECM) approach. Thus, following Pesaran (2001), we introduced the ECM

coefficient using the long-run normalized estimates to determine the speed of adjustments at which the model returns to its equilibrium. Table 11 provides the summary of the error correction representation. ECM has the correct sign (negative coefficient of -0.72) and is statistically significant at a 1% confidence level ($p<0.01$). The minus sign indicates the presence of disequilibrium in the earlier short-run period, supporting evidence of cointegration among the variables in the model. The coefficient of 0.72 suggests that 72% of the deviation from the long-run equilibrium period between variables is periodically corrected. In other words, it takes less than two years to fully correct for the deviation.

The predictors were tested at a 5% confidence level, which means that any variable that has prob ≤ 0.05 is a significant predictor of the dependent variable (AHP). The existence of a short-term relationship between AHP and the selected variables is evident from the outcome of the error correction model. The ECM results also indicate that in the short run, AHP is significantly affected by three independent variables out of the five variables under consideration. By looking at the ARDL short-run coefficients, construction permits with lags 1, 2, and 3, employment index with lags 1 and 2, and interest rate and with lags 1 and 2 are significant at the 95% confidence level.

More specifically, ΔCOP (-1) and ΔCOP (-2) are significant negative predictors of AHP which means that as construction permits increase, the average house price in Lebanon decreases one and two months later, while ΔCOP (-3) is a significant positive predictor of AHP meaning that after increasing construction permits, average house prices increase after three months. ΔEI (-1) and ΔEI (-2) are significant negative predictors of AHP which means as the cost of employment increases, the average house price decreases 1 and 2 months later. ΔUSD and ΔUSD (-2) are significant negative predictors of AHP which means that as interest on USD loans increases,

average house prices decrease both in the same month and after two months. However, ΔUSD (-1) is a significant positive predictor of AHP which means that as interest on USD loans increases, the average house price increases after one month. Finally, CPI and NR are not significant predictors of AHP in Lebanon which means that any fluctuation in Consumer Price Index and Non-Resident Deposits does not have a significant effect on average house prices in Lebanon.

Table 11: Short Term Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AHP(-1))	-0.046598	0.105834	0.105834	0.6611
D(AHP(-2))	-0.167180	0.084752	0.084752	0.0527
D(COP)	0.003013	0.035971	0.035971	0.9335
D(COP(-1))	-0.156849	0.046106	0.046106	0.0011***
D(COP(-2))	-0.172955	0.040525	0.040525	0.0001***
D(COP(-3))	2.183658	0.510399	0.510399	0.0001***
D(CPI)	-0.091482	1.023648	1.023648	0.9291
D(EI)	-1.516267	1.146667	1.146667	0.1906
D(EI(-1))	-2.680968	1.014005	1.014005	0.0102**
D(EI(-2))	-2.576872	0.834271	0.834271	0.0029***
D(NR)	1.325323	0.832267	0.832267	0.1160
D(NR(-1))	-1.148975	0.819429	0.819429	0.1655
D(NR(-2))	-1.655285	0.865822	0.865822	0.0602
D(USD)	-2.287674	0.963023	0.963023	0.0204**
D(USD(-1))	4.193677	1.135216	1.135216	0.0004***
D(USD(-2))	-3.267459	1.026436	1.026436	0.0022***
ECM(-1)	-0.721643	0.115624	0.115624	0.0000***

R-squared	0.662	Mean dependent var	11.818
Adjusted R-squared	0.565	S.D. dependent var	0.16
S.E. of regression	0.106	Akaike info criterion	-1.456
Sum squared resid	0.771	Schwarz criterion	-0.872
Log likelihood	86.506	Hannan-Quinn criteria.	-1.22
		Durbin-Watson stat	1.925

4.6. Analysis of Results

In summary, when looking at the long-run results, results show that the only factor that has an impact on housing in Lebanon is the employment index which has a positive long-term impact. This means as the cost of employment increases and subsequently employment income increases, house prices will increase. This might be due to the fact that the more income individuals and households have, the more they can afford a house or a bigger house which increases the demand for housing which, in turn, leads to an increase in house prices.

The short-run results show the variables that have a direct impact on short-term periods. First, the variables that harm house prices (ie; decreasing house prices) are the employment index (EI) and construction permits (COP). The data shows that as EI increases, house prices fall in the next month and two months respectively and as COP increases, house prices also fall in the next month and two months respectively. However, COP has a positive influence on AHP in the third month. This might be due to the fact that when construction permits are given, the housing supply increases and house constructions start with the houses still being in their basic forms. However, an increase in income should usually increase house prices. After all, an increase in EI increases house prices in the long term. This might be attributed to the fact that basic houses are unappealing to a buyer and risky since the builder might declare bankruptcy before construction is complete or might scam the buyers. Individuals with more money and more income can afford to bargain with the builder and/or owner and buy the incomplete house for cheap by paying for the house with less cash which will drive down prices. It is worth mentioning that banks do not provide any loan to buy incomplete houses unless the builder was the owner. Also, since EI is a positive influencer in the long run, when a person's income increases, their savings towards a house increase which they will later use to purchase a home and thus, will decrease spending in the short run in favor of the

long run. Several studies found a correlation between house prices and housing supply such as Wang and Rickman (2018) who concluded that land (house) supply increase halts or slightly increases house prices in China and Li and Chand (2013) who concluded that housing supply had a positive impact on house prices in China.

Results also show that interest on USD loans has a blended impact on house prices in the short-term ie; it can both increase and decrease house prices within a period of up to two months. More specifically, when the USD increases, house prices directly fall, but then increase after one month and decrease again after two months. The decrease might be due to the fact that as interest on loans increases, the cost to borrow money to buy a house increases which decreases demand on houses and in turn, decreases prices of houses. The increase, however, might be due to a panic buying which is when consumers start buying more of a certain commodity or product fearing another increase in the price later on. This often happens to basic and necessary goods such as fuel, wheat, and even houses. Therefore, an increase in interest on USD loans might lead to a panic buying which increases the demand for house loans, increasing the demand for houses which will result in an increase in house prices after one month of increase in interest on USD loans and when panic buying ends, the increase would dissuade other buyers which would decrease house prices after two months. Interest rates were studied by several researchers such as Rubio (2011), Benamraoui (2018), Bork and Moller (2018), Lim and Tsiaplias (2018), and Li et al. (2018) who found that an increase in interest rates decreases house prices and vice versa in several economies such as the US, UK, Australia, and China.

Chapter 5: Conclusions and Recommendations

5.1. Introduction

Many researchers have investigated the variables that affect house prices in several scopes from towns to metropolitan areas to nations and even coalitions. Yet most of these studies arrive at relatively the same handful of variables that seem to predict house prices in the studied area. This thesis investigates the determinants of housing prices in Lebanon using the employment Index, Interest on USD loans, Interest on LBP loans, construction permits, coincident indicators, non-resident deposits, and inflation. ARDL model is used to determine which variables have a short-run and long-run impact on house prices in Lebanon. Data is monthly from the second half of the year 2013 until February 2021. Results show that Lebanon is not different from other countries, where employment affected house prices in the long run. This was in line with several studies such as those done by Bork and Moller (2018) in the US who concluded that employment was an important predictor of house prices. Benamraoui (2018) saw a negative correlation between unemployment and house prices which implies a positive correlation between house prices and employment in the US and UK. In the short run, three variables affect house prices in Lebanon. The first, again, was employment which was discussed. The second was construction permits which represent the supply of housing. Other researchers discussed the impact of housing supply on house prices such as Wang and Rickman (2020) who studied the effect of housing supply on house prices in China and concluded that as land supply increased, house prices did not grow or grew slightly, and Li and Chand (2013) who concluded that house prices had a significant positive impact on house prices in China. The third variable was interest on loans (particularly those issued in USD) which represent the ease of access to funding a home purchase. This was also in line with

several conducted studies such as Rubio (2011) who concluded that interest rates had a strong negative impact on house prices in the US. Bork and Moller (2018) concluded that interest rates were important predictors of house prices in the US, Benamraoui (2018) concluded that interest rates had a more significant impact in the UK than in the US since UK interest rates are variable short-term and US interest rates on housing loans are fixed long-term. Lim and Tsiaplias (2018) concluded that there is a threshold interest rate below which house prices in Australia start to increase in an unstable manner. Finally, Li et al. (2018) noticed a strong positive correlation between interest rates and house prices in China.

5.2. Main Findings and Analysis of Main Results

First, the thesis concluded that the only variable that has a long-term impact on house prices in Lebanon is the employment index. This means that the higher the cost of employment and by extension the higher the employment rate, the more prices will increase. This was evident in the study of Bork and Moller (2018) who concluded that employment was one of the predicting factors of housing. Second, the thesis also looked at the factors that have a short-term on house prices in Lebanon both positively and negatively. The employment index hurt house prices in the short run; meaning that as the employment index rose, average house prices dropped. Other variables had both a positive and negative short-term impact on house prices depending on the period. The notable of these is construction permits and interest on USD loans. In the case of the former, construction permits had a negative impact after one and two months and a positive impact after the third month i.e., as construction permits rose, house prices dropped after one and two months and increased during the third month. This was certainly in line with the study done in 2013 by Li and Chand in China who also concluded that housing supply has an effect on house prices in China.

Wang and Rickman (2020) also concluded that land supply affected house prices in China. In the case of the latter, interest on USD loans had a negative impact during the same month and after the second month and a positive impact after one month i.e., as interest on USD loans rose, house prices dropped during the same month and after two months and increased after one month. This was true in the case of Rubio in 2011 who also concluded that interest on housing loans negatively impacted house prices. In 2018, Benamraoui also concluded that interest rates on housing loans affected house prices in the UK. Finally, some variables had no significant short-run and long-run impact on average house prices in Lebanon. These variables were the CPI and deposits made by non-residents.

5.3. Limitation of the Research

The findings of this thesis should be taken with its limitations in mind. The first limitation is in the dependent variable. The average house prices are the product of the value of real estate transactions divided by the number of real estate transactions in that given month. They do not necessarily represent actual housing data since real estate is both commercial and residential. Second, average house prices are not the same as median house prices which are a far more accurate representation of the actual problem. An average can have two extreme outliers that can distort the data whereas medians measure the exact center of the data points with outliers in mind. Third, there is not a wide range of datasets to choose from. For example, I wanted to add the number of vacant and unsold homes as an independent variable, however, it was nowhere to be found and no database even though of collecting data for this dataset. Fourth, the data sample is not a large data sample with less than 100 observations which decreases the accuracy of the findings as compared to a large data sample that can easily measure up to 8 lags for short-run and long-run analysis. Finally,

and an addendum to the previous limitation, there are hardly any large datasets in Lebanon on most areas in the economy where the larger datasets are collected by non-Lebanese external agencies such as the UN as opposed to countries like the USA where some datasets date back to the 19th century. This makes these kinds of theses and studies, at least in the present and near future, more difficult to perform accurately on the Lebanese economy.

5.4. Managerial Implications

This thesis resulted in valuable empirical evidence that policymakers can use to control house prices in Lebanon which have always been an issue in Lebanon. It determines which variables mostly affect house prices in Lebanon and in turn, will help policymakers choose which variables to target in order to improve or stabilize house prices. Moreover, it will also help real estate investors and developers know when and how to build prices that give them the most profitability while being more affordable to buyers. A developer would know to slow down the production of new houses when employment is slowing down and vice versa. Finally, it can also help the average house buyers determine the best time to buy a house for the most value they can obtain. They would know that if interest is high, then prices would be low and vice versa and if new housing construction sprung up in the area, it would be cheaper to buy before two months of inception.

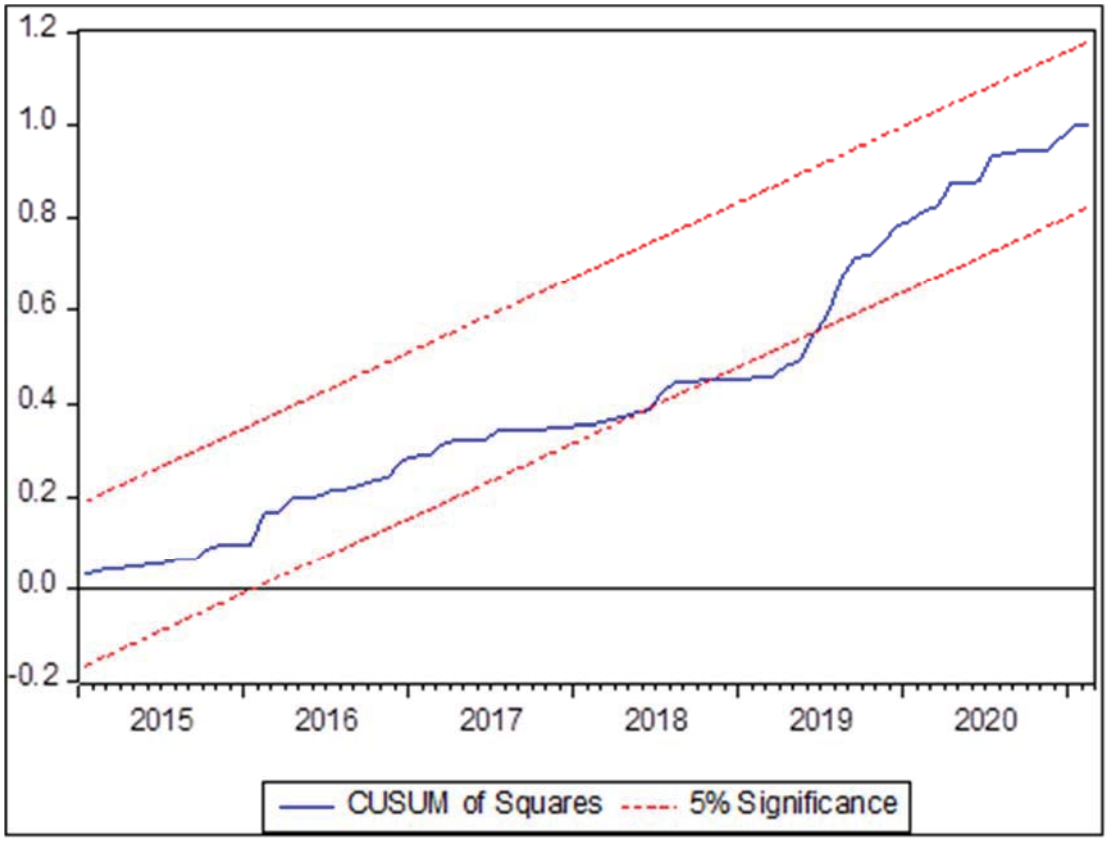
5.5. Recommendations

This thesis resulted in evidence that government and the private sector alike can work on controlling house prices in Lebanon or at the very least, affordability. Policymakers can focus on improving employment conditions and manipulate interest rates on USD loans to stabilize house prices. This can be done in the form of tax credits on income or tax incentives for investors who will create new jobs. Similarly, real estate investors can work to build more affordable housing

that the average graduate can afford to purchase or rent. With the right policies that tackle interest, income, and housing supply in a productive manner, houses can be more affordable to the average Lebanese individual and/or newly-wed couple.

Appendix:

CUSUM square when using the coincident indicator in our regression model



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